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PHYSICS ABSTRACTS

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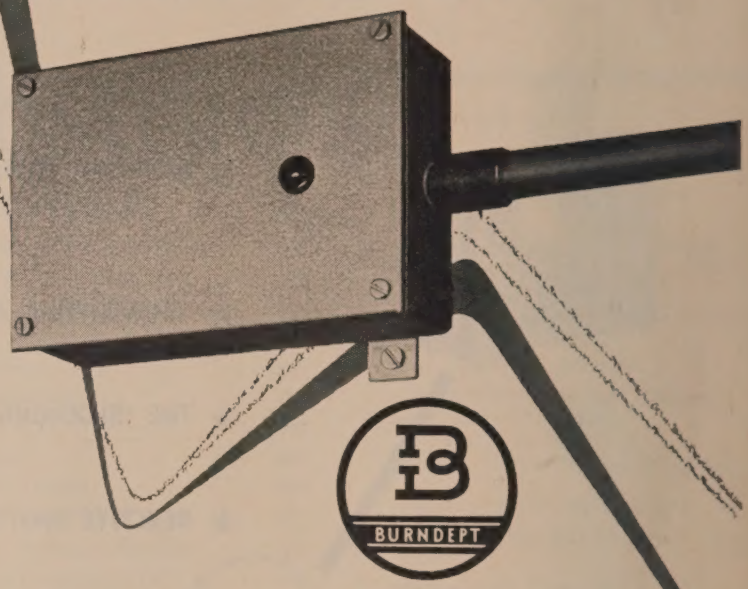

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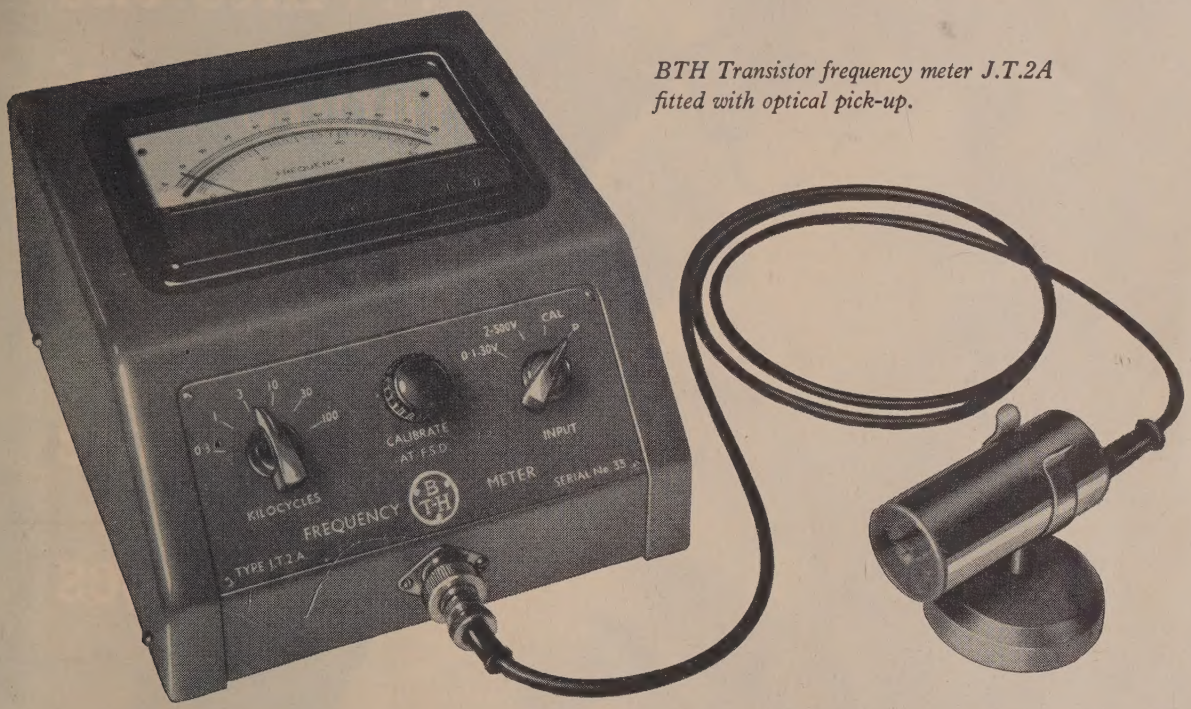

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PHYSICS ABSTRACTS

Volume 61 JULY 1958 Number 727

MATHEMATICS

512.94 : 548.12

SYMMETRY OF SCALARS, VECTORS AND SECOND RANK TENSORS. See Abstr. 3554

517.3

3628. TABLE OF THE FUNCTION $y = e^{-x^2} \cdot \int_0^x e^{t^2} dt$.

B.Lohmander and S.Rittsten.
K. Fysiogr. Sällsk. Lund. Forhandl., Vol. 28, No. 6, 45-52 (1958).

The tables give values of the function and modified second central differences to 10 places for $x = 0\ (0.01)\ 3\ (0.02)\ 5$, also for $x^{-1} = 0\ (0.005)\ 0.2$; further values to 20 places are given for $x = 0\ (0.5)\ 10$. In addition, the maximum and inflection points of the function are given to 20 places. The tables were obtained by integrating the differential equation satisfied by the y by the Taylor series expansion method. Errors in the previously published tables of the same function are mentioned. M.J.Kearsley

517.3

3629. ON THE MODIFICATION OF FEYNMAN'S "INTEGRAL-OVER-ALL-PATHS" METHOD. J.Łopuszański.
Nuovo Cimento Suppl., Vol. 7, No. 1, 61-76 (1958).

A new technique for computing Feynman's "integrals over all paths". R.J.N.Phillips

517.948 : 530.145

3630. ON THE SOLUTION OF CERTAIN SINGULAR INTEGRAL EQUATIONS OF QUANTUM FIELD THEORY. R.Omnès.
Nuovo Cimento, Vol. 8, No. 2, 316-26 (April 16, 1958).

In the study of complex phenomena involving π-mesons (e.g. simple and double photoproduction, radiative scattering, double production, etc.) one encounters singular integral equations linking the matrix elements and phase-shifts. A general method of resolution of these equations is given which furnishes the following results: (a) the simplest type is integrable by quadratures; (b) the general type is reducible to a Fredholm equation. The solution is also given of a system of coupled integral equations and of the particular one which occurs in the double production problem. This last case may be integrated by quadratures. A.

518.5

3631. CENTROIDS, VECTORS, AND LEAST SQUARES. S.I.Askovitz.
Amer. J. Phys., Vol. 26, No. 3, 164-8 (March, 1958).

A mechanical model is presented which corresponds to the mathematical problem of determining the straight line best fitting a series of points according to the least squares criterion. The model consists essentially of a bar in equilibrium under the action of suitably arranged springs. By applying certain relationships between centroids of points and vectors in equilibrium, two points can be located which determine the correct line. A graphic method can thereby be developed for drawing the line without any calculation. The technique is illustrated for the case of three points. A.

518.5 : 535.66 : 535.415

CALCULATING INTERFERENCE COLOUR OF THIN FILMS USING AN AUTOMATIC RELAY COMPUTER. See Abstr. 3000

518.61 : 536.2.01

3632. A METHOD FOR THE NUMERICAL INTEGRATION OF THE LINEAR DIFFUSION EQUATION. D.R.Hartree.
Proc. Cambridge Phil. Soc., Vol. 54, Pt 2, 207-13 (April, 1958).

In one numerical method for integration of the diffusion equation in one dimension, the time derivative is replaced by a finite difference in a time interval, and the space derivative by the mean of its values at the beginning and end of the interval. This leads to a set of ordinary differential equations, one for each interval, which have to be solved in succession. Each of these equations is second-order with two-point boundary conditions; the process of integration from one end is severely unstable, the more so the smaller the time interval. This paper is concerned with a practical, direct and stable method for solving them by integration of two first-order equations, one being integrated inwards and the other outwards, one boundary condition being satisfied in each integration. The extension to axially symmetrical diffusion is briefly considered. A.

ASTRONOMY . ASTROPHYSICS

522.615 : 535.33.03

3633. A DIRECT-RECORDING PHOTOELECTRIC SPECTROPHOTOMETER. W.Liller.
Publ. Astron. Soc. Pacific, Vol. 69, 511-17 (Dec., 1957).

The instrument has F/5 mirrors, a blazed grating and a 20-stage photomultiplier for use with astronomical telescopes. The range is from 3200 to 12 000 A, and the useful resolution may be as good as 4 A. G.F.Lothian

523.03 : 523.8

3634. THEORETICAL ASTROPHYSICS.
Edited by V.A.Ambartsumyan and translated by J.B.Sykes.
London, New York, Paris, Los Angeles: Pergamon Press (1958) x + 645 pp.

A translation of the 1952 Russian edition, together with some references to later work. The contributors are E.R.Mustel', A.B.Severnyi, V.V.Sobolev and the editor. The book provides a comprehensive survey of some modern developments, with constant references to observational data and to recent research papers. The topics covered are: the theory of stellar photospheres and the continuous spectrum of stars; formation of absorption lines, interpretation of observed line contours and of the spectral sequence; electrodynamics of the sun's atmosphere, sunspots, faculae, prominences, flocculi, flares, solar radio emission; the mechanism of radiation and the physical state of matter in planetary nebulae; novae; stars with bright spectral lines; the internal structure of stars; the scattering of light in planetary atmospheres; interstellar matter. The bibliography contains 183 references, more than half of which are to papers in Russian journals. R.A.Newing

523.11

3635. A STATIC COSMOLOGICAL MODEL. D.K.Sen.
Z. Phys., Vol. 149, No. 3, 311-23 (1957).

A static cosmological model of the universe based on Lyra's modified Riemannian geometry is proposed. The red-shift of spectral lines from extra-galactic nebulae is shown to be a consequence of an inherent geometrical property of the model independent of expansion. The model is similar to the static Einstein model but shows a red-shift and has a finite density even without the introduction of a cosmological constant. A.

523.11

3636. DISRUPTION OF GALACTIC CLUSTERS. L.Spitzer, Jr.
Astrophys. J., Vol. 127, No. 1, 17-27 (Jan., 1958).

The tidal force of passing interstellar clouds accelerates the stars in a galactic cluster, increases the total cluster energy, and leads to the expansion and ultimate disruption of the cluster. The magnitude of this effect is computed on the impulsive approximation,

i.e. on the assumption that the stars do not move appreciably as a cloud passes by. Solution of the more general problem, on the simplifying assumption that the gravitational potential of the cluster varies as the square of the distance from the centre, shows that the impulsive approximation should usually be adequate. The computed rate of increase of internal cluster energy, resulting from encounters with clouds, is about thirty times the corresponding rate for encounters with field stars, if a cluster radius of 5 parsec is assumed. The "disruption time" required for a cluster to dissociate into separate stars varies directly with the cluster density and is about 2×10^8 years for a mean density of 1 M ⊙/parsec^3. The stars of relatively low mass in a cluster will be lost more rapidly, partly by evaporation and partly by enhanced disruption of the extended aura which these stars presumably form about the cluster. This mechanism may account for the scarcity galactic clusters older than 10^9 years. A.

523.164.3

3637. RADIO NOISE FROM PLANETS. F.Horner.
Nature (London), Vol. 180, 1253 (Dec. 7, 1957).

The intensities of radio noise from Venus and Jupiter are compared with h.f. noise from terrestrial lightning flashes, and it is concluded that the hypothesis of origin in individual terrestrial-type flashes fails to account for the planetary observations by a factor exceeding 10^6. If the observed noise is from a multiplicity of flashes, the occurrence of individual bursts requires explanation. Alternatively, it must be supposed that the discharges are of different forms, the planetary ones producing more h.f. radiation.
M.W.Ovenden

523.164.3

3638. PROPAGATION OF RADIO WAVES FROM COSMICAL SOURCES. E.Chvojková.
Nature (London), Vol. 181, 105 (Jan. 11, 1958).

The propagation of a radio wave from an unionized medium (where its path is rectilinear) through a spherical ionized shell is examined. The rectilinear part of the ray path is rotated about the centre of curvature of the ionized layer by the angle of refraction R, where R depends only upon the angle of incidence, the ratio of the wave frequency to the critical frequency of the layer, and the content of free electrons in the layer. It is independent of the electron distribution within the layer. The theoretical results are in good agreement with observations of the signals from the first artificial earth-satellite.
M.W.Ovenden

523.164.3

3639. DETERMINATION OF RADIO-PROPAGATION ELEMENTS DUE TO AN ARTIFICIAL EARTH SATELLITE. E.Woyk-Chvojková.
Nature (London), Vol. 181, 1195-6 (April 26, 1958).

The author's method of determining the refraction of a radio signal-path originating in a cosmic source and penetrating the ionosphere (see preceding abstract) was modified to give an expression for the length of a radio path between a satellite and the recorder, and for determining the apparent position of the satellite relative to the true position. Small differences between the radio and optical Doppler drift may occur.
M.W.Ovenden

523.164.32

3640. POLARIZATION OF SOLAR RADIO OUTBURSTS.
K.Akabane and T.Hatanaka.
Nature (London), Vol. 180, 1062-3 (Nov. 16, 1957).

Continuous records of the I, V, Q and U Stokes's parameters of polarization on 9000 Mc/s are reproduced for 3 July 1957. Attention is drawn to changes of polarization occurring simultaneously with three large solar flares.
M.W.Ovenden

523.164.32

3641. A NEW SPECTRAL CHARACTERISTIC IN SOLAR RADIO EMISSION. A.Maxwell and G.Swarup.
Nature (London), Vol. 181, 36-8 (Jan. 4, 1958).

A 28 ft paraboloid, equatorially mounted with solar guiding, has three primary arrays co-axially mounted at its focus and individually connected to sweep-frequency receivers covering the bands 100-180, 170-330 and 300-380 Mc/s, with a sweep period of $\frac{1}{4}$ sec. A continuous film record (by cathode-ray tube displays) of the intensity of solar noise as a function of frequency and time is made for each band. Attention is drawn to a new type of solar burst, appearing as an inverted U on the records, and well correlated in time with optical observations of solar flares. A theory due to Krook of the origin of these bursts in terms of shock waves in the solar atmosphere in the magnetic fields of bipolar spots is outlined.
M.W.Ovenden

523.164.4

3642. COSMIC RADIO-NOISE INTENSITIES BELOW 10 Mc/s. G.R.Ellis.
J. geophys. Res., Vol. 62, No. 2, 229-34 (June, 1957).

The results of observations of cosmic noise at frequencies of 10.05, 5.65, 4.4 and 3.8 Mc/s are reported. At the three highest frequencies, half-wave dipole aerials were used, while at 3.8 Mc/s the aerial system was an array with a beam-width of 50° by 26°. In addition, previous observations at 2.13, 1.43 and 0.9 Mc/s were reassessed. It was found that the increase in the intensity of the radiation with decreasing frequency ceases at about 10 Mc/s, and that the spectrum is flat between 10 and 2 Mc/s, and possibly to 0.9 Mc/s. The flux density of the radiation at these frequencies is approximately 2×10^{-19} Wm^{-2}(c/s)$^{-1}$, the equivalent temperatures varying from 6×10^5 degrees at 10 Mc/s to 3×10^7 degrees at 0.9 Mc/s. A.

523.164.42

3343. COSMIC RADIO-FREQUENCY RADIATION NEAR ONE MEGACYCLE. G.Reber and G.R.Ellis.
J. geophys. Res., Vol. 61, No. 1, 1-10 (March, 1956).

Observations of cosmic r.f. radiation on frequencies of 2130, 1435, 900 and 520 kc/s were made, using a method of recording which effectively reduces interference from atmospherics. At these frequencies, the intensity of the radiation is approximately 10^{-19} Wm^{-2}(c/s)$^{-1}$ sterad^{-1}. The ionospheric effects associated with observations near the critical frequency are discussed. A.

523.164.42

3644. FLUX MEASUREMENTS OF DISCRETE RADIO SOURCES AT FREQUENCIES BELOW 30 MEGACYCLES. H.W.Wells.
J. geophys. Res., Vol. 61, No. 3, 541-5 (Sept., 1956).

The report presents results of flux measurements at frequencies below 30 Mc/s and describes steps taken to minimize errors. At 26.75 Mc/s, Taurus A and Virgo A appear to be approximately equal at 85×10^{-24} W m^{-2} (c/s)$^{-1}$, and at 18.5 Mc/s the intensity of Virgo A has risen to 150×10^{-24} W m^{-2} (c/s)$^{-1}$. The ratio of relative amplitudes of Cygnus A to Cassiopeia A is 0.6 at 26.75 Mc/s, and drops to 0.5 at 18.5 Mc/s, suggestive of enhanced absorption of Cygnus A. Plans and probable limitations of further l.f. observations are discussed. A.

523.164.85

3645. RESONANCE EFFECTS IN THE THEORY OF METEOR OBSERVABILITY. D.R.Moorcroft and C.O.Hines.
Canad. J. Phys., Vol. 36, No. 1, 134-6 (Jan., 1958).

A simplified theory of resonance for forward-scattering of radio waves by meteor trails (in the limiting case of an extremely sensitive observing system) gives an enhancement factor of 2. Phase-shifts between resonant and non-resonant components are ignored. Normalized contours of meteor observability as a function of trail orientation are given on the new theory, and compared with similar curves for which allowance for resonance was not made.
M.W.Ovenden

523.164.85

3646. METEOR ECHOES AT ULTRA-HIGH FREQUENCIES. W.A.Flood.
J. geophys. Res., Vol. 62, No. 1, 79-91 (March, 1957).

It is proposed that, at u.h.f., under-dense meteor echoes have an effective scattering length that is much less than a Fresnel zone. Consequently, u.h.f. meteoric echoes may be analysed in terms of Fraunhofer diffraction theory, resulting in a relaxation of the requirement that a meteor trail be perpendicular to the radar line-of-sight before an echo can be received. Formulae for the back-scattered power, time duration, and echo rate are deduced.
A.

523.5

3647. PROBLEMS IN THE PHYSICS OF METEORS. E.J.Öpik.
Amer. J. Phys., Vol. 26, No. 2, 70-9 (Feb., 1958).

Some basic notions of the physics of meteors are illustrated and recent developments mentioned. Values of the efficiency of meteor radiation in visible light, formulae for the calculation of meteor masses, tables for the ionizing efficiency, depth of penetration of the ions, and the selectivity of radar observations with respect to velocity are given. The importance of initial penetration of the high velocity ions in determining the radius of the ionizing column, and the selectivity of radar observations, biased against velocities exceeding 50 km/s, are pointed out. The dust ball nature of visual meteors is described. The insignificant share of nickel–iron in meteoric populations is stressed. Systematic errors in correlating meteor decelerations with atmospheric densities are discussed. A.

523.5 : 551.590.2

3648. RATE OF ACCRETION OF COSMIC DUST ON THE EARTH. H.Pettersson.
Nature (London), Vol. 181, 330 (Feb. 1, 1958).

Ni content of air at 11 000 ft in Hawaii was 14.3 $\mu g/1000\ m^3$, and Fe content 1577 $\mu g/1000\ m^3$. For an average Ni content of meteorites of 2.5%, this gives 28.6×10^6 tons of cosmic dust below the 100 km level. If this is renewed every two years, the rate of accretion is about four time larger than the highest previous estimates.

E.J.Burge

523.6

3649. POLARISATION OF COMET AREND–ROLAND. M.K.V.Bappu and S.D.Sinvhal.
Nature (London), Vol. 180, 1410 (Dec. 21, 1957).

A description is given of the techniques used in carrying out a series of photoelectric measurements of the polarization of the comet's coma at different phase angles. The results show that the planes of polarization at any one time, obtained through the three different filter bandwidths considered, are equal. Also the change in the plane of polarization with time is linear, but it is more rapid than the change in the position angle of the intensity-equator during the same time interval. T.W.Olle

523.75

3650. ABSORPTION OF COSMIC RADIO NOISE AT 22.2 Mc/sec FOLLOWING SOLAR FLARE OF FEBRUARY 23, 1956. S.E.Forbush and B.F.Burke.
J. geophys. Res., Vol. 61, No. 3, 573-5 (Sept., 1956).

523.76

3651. ON SOLAR MODELS. P.Naur.
Astrophys. J., Vol. 126, No. 1, 227-8 (July, 1957).

523.77 : 535.337

3652. THE SOLAR PHOTOSPHERIC EMISSION LINES INSIDE H AND K. M.Rudkjøbing.
Ann. Astrophys., Vol. 20, No. 3, 137-8 (May-June, 1957).

Emission lines found inside H and K at the edge of the sun are interpreted as true absorption lines, the background intensities being lower than corresponding to the surface temperature due to the occurrence of scattering in the strong lines. A.

523.77

3653. CARBON MONOXIDE IN THE SOLAR ATMOSPHERE. G.Newkirk,Jr.
Astrophys. J., Vol. 125, No. 2, 571-93 (March, 1957).

Twenty-three solar carbon monoxide lines are analysed with respect to their equivalent widths at the centre of the disk and their increase toward the limb. Excitation temperatures of 4880^0 K at $\cos\theta = 1.0$, and 4590^0 K at $\cos\theta = 0.2$, are determined. The method of weighing functions is used to test the accuracy of the uppermost strata of three previously described models by means of their ability to predict the observed equivalent widths and centre-to-limb behaviour. The composite model proposed by Minnaert appears to be the most satisfactory of the three considered. The logarithmic abundance of carbon determined from this model is 6.72, when the logarithmic abundance for hydrogen is 10.000. The influence of a lateral temperature structure in this model is explored. A.

523.77

3654. THE CONTINUOUS SPECTRUM AND TEMPERATURE OF THE SUN. D.Labs.
S.B.Heidelberg. Akad. Wiss. (math. nat. Kl.), 1956-57, No. 4, 408-12. In German.

Precise spectrophotometric observations of the solar continuum (made in the Pyrenees during Sept.-Oct., 1955) in the spectral range from 3500 to 7000 A, using a carbon-arc comparison, yield for the intensity of solar radiation at $\lambda^{-1} = 1.9$ a value of 43.8×10^{13} erg $cm^{-2}\ sec^{-1}$. This corresponds to a brightness temperature of 6470^0 K. D.R.Barber

523.77 : 523.87

3655. AN EXPERIMENTAL EXAMINATION OF PRESSURE-BROADENING OF IRON LINES BY THE HYDROGEN ATOM AND MOLECULE. H.J.Kusch.
Z. Astrophys., Vol. 45, No. 1, 1-16 (1958). In German.

The theoretically predicted influence of neutral H and of H_2 on the observed widths of Fe I lines in solar and stellar spectra is confirmed experimentally for lines emitted by an Fe–H plasma, and for absorption lines in the presence of H_2. A similar pressure-broadening effect is also reported for the Ca resonance line (4227 A) from a Ca–Fe–H_2 plasma at T = 2170^0K. D.R.Barber

523.77.08

3656. PHOTOELECTRIC RECORDING AND PHOTOMETRY OF FACULAE AND (CHROMOSPHERIC) ERUPTIONS. K.O.Kiepenheuer and F.L.Deubner.
Z. Astrophys., Vol. 45, No. 1, 17-23 (1958). In German.

Independent scanning of solar plages (faculae) and flares (chromospheric eruptions) in N and S hemispheres is achieved by a photoelectric spectrophotometer, based on the principle of the spectroheliograph. The apparatus includes a monochromator and two matched photomultiplier cells coupled to a balanced amplifier and recording galvanometer. Recording is done in the light of the Ca K line (3934 A), and some examples are given illustrating short-period fluctuations in facular brightness. D.R.Barber

523.775

3657. DOPPLER MOTIONS IN THE CORONA. G.Newkirk, Jr.
Ann. Astrophys., Vol. 20, No. 3, 127-36 (May-June, 1957).

Doppler motions in the corona over 24 active regions were measured in detail. The coronal Doppler features coincide with active loop prominences, in which the yellow coronal line (5694 A) is observed. The velocities of the coronal material are, in general, of smaller magnitude but of the same sign as those of the associated prominence. A model of the motions is developed to explain the statistical velocity distributions. The analysis indicates that expansion or contraction of the magnetic field defining the loop gives rise to the Doppler features. Apparently, the coronal material moves much slower along the magnetic lines of force than does the hydrogen. A.

523.775

3658. CHROMOSPHERIC STRUCTURE IN BALMER LINES. E.H.Schröter.
Z. Astrophys., Vol. 45, No. 1, 68-80 (1958). In German.

High-resolution spectra of the first four solar hydrogen lines observed in Potsdam under excellent seeing conditions show line structures of chromospheric origin. Using the method of "curves of constant density" the author investigated: (a) the diameter of the chromospheric elements, (b) the correlation between the width of the core and the central intensity, (c) the random shift of the cores of the four hydrogen lines, (d) the correlation between the direction of the line shift and the width of the core. An asymmetry of the contours of Hα and Hβ was found. Preliminary results are given on the granular Doppler-shifts of faint metallic lines, which show variations of width and Doppler-shifts too. For two faint lines, measured with great accuracy, an asymmetry opposite to that in the cores of the hydrogen lines was found. A.

523.755 : 550.38

GEOMAGNETISM AND THE EMISSION-LINE CORONA. See Abstr. 3603

523.877

3659. THEORY OF CONTINUOUS STELLAR SPECTRA. (SUMMARY). A.Unsöld.
S.B. Heidelberg. Akad. Wiss. (math. nat. Kl.), 1956-57, No. 4, 383-4. In German.

The following subjects are briefly reviewed: (a) relation between radiation intensity, radiation flux and emissivity in stellar atmospheres; (b) continuous absorption and scatter of H, He and metallic ions, negative H ions, and H_2 molecules; (c) model stellar atmospheres and the theory of radiative equilibrium; (d) comparison between theory and observation — effective stellar temperatures, gravitational parameter g and spectral type, Balmer and Paschen discontinuities. D.R.Barber

523.877 : 533.16 : 536.23

3660. THE COEFFICIENTS OF VISCOSITY AND THERMAL CONDUCTIVITY IN THE HYDROGEN CONVECTION ZONE. F.N.Edmonds, Jr.
Astrophys. J., Vol. 125, No. 2, 535-49 (March, 1957).

The coefficient of viscosity, the coefficient of thermal conductivity by conduction, and the coefficient of the thermal conductivity by radiation, were calculated for stellar material (85% hydrogen, 15% helium) over temperature and pressure ranges that should include the hydrogen convection zones of most stars. A.

525.3

3661. PROGRESS OF SPUTNIK 2 (1957β). D.G.King-Hele.
Nature (London), Vol. 181, 738-9 (March 15, 1958).

A summary of the changes of orbital elements, with emphasis on unexplained fluctuations. A table gives elements for four widely-spaced dates. M.W.Ovenden

525.3 : 523.164.8

3662. RADIO OBSERVATIONS OF THE FIRST ARTIFICIAL EARTH SATELLITE. W.Priester, H.G.Bennewitz and P.Lengrüsser. Wiss. Abhandl. Arbeitsgemeinschaft Forsch. Nordrhein-Westfalen, Vol. 1, 38 + vi pp. diagrams (1957). In German.

Field-strength and Doppler effect measurements on the 20 and 40 Mc/s transmissions are described in detail, with tables of observations and specimen records. The orbital elements and their time variations are deduced, and a table of them is given. The precession of the orbit of $2^\circ\ 9' \pm 0^\circ\ 20'$ per day is in good agreement with theory (Abstr. 1458/1958). The atmospheric density at a height of 215 km (latitude 42° N) is found to be 4.7×10^{-13} g/cm^3.

M.W.Ovenden

525.3

3663. LIFE-TIME OF AN ARTIFICIAL EARTH SATELLITE. D.C.M.Leslie.
Nature (London), Vol. 181, 403-4 (Feb. 8, 1958).

Application of the first-order perturbation theory to the motion of a satellite with constant drag coefficient and a purely axial force, using a simple exponential atmospheric model, shows that the approximations of Fejer and Scott (Abstr. 1463-4/1958) are in fact valid down to $e = 0$. The lifetime of a satellite is given by

$$\tfrac{3}{4}e_0 \cdot \frac{T_0}{(-dT/dt)_0}$$

(to order e_0) from a time when the eccentricity, period and rate of change of period are e_0, T_0 and $(dT/dt)_0$ respectively.

M.W.Ovenden

525.3

3664. CALCULATION OF THE LIFE-TIME OF A SATELLITE. D.G.Parkyn.
Nature (London), Vol. 181, 1156-7 (April 19, 1958).

The analysis of Scott (Abstr. 1464/1958) is modified to correct for the lack of spherical symmetry of the atmosphere due to the rotation and oblateness of the earth. The correction implies a shortening of the lifetime of 1957β by 7 days. The variation of the periodic time T provides a check on the analysis. A table compares observations with predictions for 1957β. Agreement is within 0.02%, and a reduction of only 0.02 min. in T would give four-figure agreement throughout. M.W.Ovenden

525.3

3665. EFFECT OF THE EARTH'S EQUATORIAL BULGE ON THE LIFE-TIME OF ARTIFICIAL SATELLITES AND ITS USE IN DETERMINING ATMOSPHERIC SCALE HEIGHTS. G.V.Groves.
Nature (London), Vol. 181, 1055 (April 12, 1958).

The simple formula for the lifetime T of a satellite in an orbit of semi-major axis a, eccentricity e and period P, moving in an atmosphere of scale height k^{-1}, namely

$$T = \tfrac{3}{4}Pe\,(1 + \tfrac{7}{8}e + \tfrac{1}{2}kae)/(-\frac{dP}{dt}),$$

requires modification for the earth's oblateness, owing to the latitude change of perigee. Perigee air-densities are uncertain due to uncertainty of k and to the drag characteristics of the satellite, but density ratios for the same satellite are more reliable. Changes in ratio which cannot be accounted for by changes of perigee-distance can be attributed to the oblateness effect. Application is made to the orbit of 1957β, and scale heights are calculated.

M.W.Ovenden

525.3

3666. THE EFFECT OF GEOPHYSICAL FACTORS UPON THE MOTION OF A SATELLITE. I.M.Yatsunskiĭ.
Uspekhi fiz. Nauk, Vol. 63, No. 1a, 59-71 (1957).

The geophysical factors considered are air resistance and variation of gravity due to non-sphericity of the earth. Also discussed is the possibility of determining air density, the constants of the terrestrial ellipsoid and gravitation anomalies from observations on the satellite. C.R.S.Manders

525.31

3667. VARIATION IN THE SPEED OF ROTATION OF THE EARTH SINCE JUNE 1955.
L.Essen, J.V.L.Parry, W.Markowitz and R.G.Hall.
Nature (London), Vol. 181, 1054 (April 12, 1958).

Measurements of the Cs resonance frequency [transition $(4,0) \rightleftharpoons (3,0)$] in terms of the second of Universal Time (based on the rotation period of the Earth) reveal a progressive increase in the length of the day between July 1955 and January 1958 equivalent to an increase in the period of rotation of the Earth of 0.43 msec/yr.

D.R.Barber

526.7 : 550.312

CALIBRATION OF GRAVITY METERS. See Abstr. 3599

PHYSICS

53.081

3668. IMPORTANCE OF THE FARADAY TO ELEMENTAL CONSTANTS AND ELECTRICITY STANDARDS.
A.G.McNish and R.D.Huntoon.
Nature (London), Vol. 181, 1194 (April 26, 1958).

It is shown that the ratio e/m for the electron can be determined from the gyromagnetic ratio of the proton, the cyclotron frequency of the proton and the Faraday independently of the electricity standards and the acceleration due to gravity. Alternatively, the electricity standards may be checked. A.H.Cook

53.081.6

3669. DO THE "CONSTANTS OF NATURE" CHANGE WITH TIME?
D.H.Wilkinson.
Phil. Mag. (Eighth Ser.), Vol. 3, 582-5 (June, 1958).

The age of minerals determined by radioactive methods agrees roughly with the age of the galaxy. This suggests that radioactive alpha-decay constants have probably changed by less than a factor of 3 or 4 during the last 3 or 4×10^9 years. It is shown that this implies that many "constants of nature", particularly e, h and c probably change more slowly than 10^{-12} parts per year. The meson coupling constant also appears to change more slowly than this and the beta-coupling constants by less than 10^{-9} parts per year.

A.

FUNDAMENTALS

530.1 : 519.2

3670. PROBABILITY AND DETERMINISM. M.L.Yevick.
Amer. J. Phys., Vol. 25, No. 8, 570-80 (Nov., 1957).

Various physical examples are given in which the probability distribution can be traced back to its causal origin. It is argued that probability is never irreducible, but is, in principle, always derivable from a deterministic process which determines its numerical value. It is suggested that deterministic and probabilistic theories are interlocked, each presenting a different aspect of reality, but that no description of the laws of nature in terms of either of these concepts will ever be ultimate. A.

530.12

3671. SCHWARZSCHILD TRAJECTORIES AND NEWTONIAN TRAJECTORIES. M.Cahen.
C.R. Acad. Sci. (Paris), Vol. 246, No. 3, 386-8 (Jan. 20, 1958).
In French.

The trajectories associated with the non-relativistic Kepler problem define an affine connection with zero torsion. It is shown that there is no Einstein space in geodesic correspondence with this "Kepler" space. R.A.Newing

530.12

3672. THE GRAVITATIONAL EFFECT OF SPIN.
O.Costa de Beauregard.
C.R. Acad. Sci. (Paris), Vol. 246, No. 4, 561-4 (Jan. 27, 1958).
In French.

For previous work see Abstr. 1471 (1958). Results previously derived from inductive arguments are now shown to follow from a detailed investigation based on an asymmetric metric tensor.

R.A.Newing

530.12 : 538.3

3673. THE EQUATIONS OF ELECTROMAGNETIC INDUCTION.
Pham Mau Quan.
C.R. Acad. Sci. (Paris), Vol. 246, No. 5, 707-10 (Feb. 3, 1958).
In French.

An electromagnetic induction is defined in Riemannian space–time when there exists two antisymmetric fields G and H such that

$G_{\alpha\beta}e^{\alpha} = \epsilon^{\rho}_{\beta}H_{\beta\rho}e^{\alpha}$, and $\mu^{\rho}_{\beta}G^{*}_{\alpha\rho}e^{\alpha} = H^{*}_{\alpha\beta}e^{\alpha}$, where G^{*} and H^{*} are the dual fields and e^{α} is a time-like vector. The case of an isotropic medium is considered, and the existence is established of two characteristic varieties associated respectively with the Maxwell and Einstein field equations. R.A.Newing

530.12

3674. ON GRAVITATIONAL WAVES AND RADIATIONS. A.Lichnerowicz.
C.R. Acad. Sci. (Paris), Vol. 246, No. 6, 893-6 (Feb. 10, 1958). In French.

The relations satisfied by the discontinuities in the curvature tensor at a wave-front are discussed, and the special cases of "total pure radiation" and "pure gravitational radiation" are defined. The effect of a combined gravitational and electromagnetic wave upon the motion of a charged test particle is briefly considered. R.A.Newing

530.12

3675. GRAVITATIONAL RADIATION. W.B.Bonnor.
Nature (London), Vol. 181, 1196-7 (April 26, 1958).

A new method of approximation, involving the expansion of the metric tensor in terms of two parameters, is applied to the motion of two equal masses oscillating in a straight line with symmetry about the centre of gravity. It is found that for $-\infty < t < +\infty$ the system loses gravitational mass due to the emission of gravitational radiation. G.Stephenson

530.12

3676. GRAVITATIONAL WAVES IN GENERAL RELATIVITY. I. CYLINDRICAL WAVES. L.Marder.
Proc. Roy. Soc. A, Vol. 244, 524-37 (April 22, 1958).

Known cylindrical-wave solutions of the free-space gravitational field equations are super-imposed on a static field and extended to the interior of a generating cylinder of matter. It is shown that the waves propagate energy. The interior and exterior field of a static cylinder of approximately constant density is obtained. A.

530.12 : 531.18

3677. RELATIVISTIC ABERRATION FORMULA. J.H.M.Whiteman.
Nature (London), Vol. 181, 560-1 (Feb. 22, 1958).

It is objected that the accepted formula relates measures made in different frames of reference. A modified formula relates the apparent and actual directions of a source measured relative to the frame of the observer. R.A.Newing

530.12

3678. CONTRACTION OF TIME AND PROTOPLASM. A.Nettleship.
Nature (London), Vol. 181, 562 (Feb. 22, 1958).

530.12

3679. SPACE TRAVEL AND THE CLOCK PARADOX. M.Born.
Phys. Blätt., Vol. 14, No. 5, 207-12 (1958). In German.

The paradox is formulated in terms of three observers, and the discussion is based on Bondi's article in Discovery, Vol. 18, No. 12, 505-10 (1957). R.A.Newing

530.12

3680. ON THE CLOCK PARADOX. M.Born and W.Biem.
Proc. K. Ned. Akad. Wetensch. B, Vol. 61, No. 2, 110-20 (1958). In German.

The distinction between intertial and non-inertial systems in the special theory is emphasized, and a careful discussion of the paradox is given within the framework of the general theory of relativity. R.A.Newing

530.12

3681. COMPARISON BETWEEN THE ENERGY–MOMENTUM TENSOR METHOD AND THE METHOD OF SINGULARITIES [IN DETERMINING THE EQUATIONS OF MOTION IN GENERAL RELATIVITY]. Pham Tan Hoang.
C.R. Acad. Sci. (Paris), Vol. 246, No. 10, 1497-500 (March 10, 1958). In French.

530.12

3682. THE PROPAGATION OF DISCONTINUITIES IN THE RIEMANN TENSOR. A.Trautman.
C.R. Acad. Sci. (Paris), Vol. 246, No. 10, 1500-2 (March 10, 1958). In French.

It is shown that the change in the discontinuity along a gravitational ray can be defined in terms of a set of ordinary differential equations. The equations are integrated in the case of a Schwarzschild field and the discontinuity is found to tend asymptotically to zero. R.A.Newing

530.12

3683. THE PROBLEM OF EVOLUTION IN THE CASE OF A PURE MATTER FIELD. Y.Fourès-Bruhat.
C.R. Acad. Sci. (Paris), Vol. 246, No. 12, 1809-12 (March 24, 1958). In French.

An existence and uniqueness theorem for the initial value problem is established in the case of an interior field for which the energy-momentum tensor is of the form $\rho u^{i}u^{j}$. R.A.Newing

530.12

3684. DISCUSSION OF A PARTICULAR SOLUTION OF THE EQUATIONS OF GENERAL RELATIVITY OBTAINED BY CHOOSING THE TENSOR OF THE BORN–INFELD ELECTROMAGNETIC THEORY AS ENERGY–MOMENTUM TENSOR. J.Lameau.
C.R. Acad. Sci. (Paris), Vol. 246, No. 9, 1384-6 (March 3, 1958). In French.

See Abstr. 869/1958.

530.12

3685. VERIFICATION OF THE GENERAL THEORY OF RELATIVITY BY MEANS OF EARTH SATELLITES. F.Winterberg.
Nuovo Cimento, Vol. 8, No. 1, 17-31 (April 1, 1958). In German.

In a review of the possibility of devising observational tests, attention is given to the effect of the rotation of the earth upon the relativistic perturbations of a satellite orbit. The possibility of verifying the relativistic red-shift by comparing the rates of earth and satellite atomic clocks is also discussed. R.A.Newing

530.12

3686. THE CONCEPT OF ORDER. III. GENERAL RELATIVITY AS A TECHNIQUE FOR EXTRAPOLATING OVER GREAT DISTANCES. E.W.Bastin and C.W.Kilmister.
Proc. Cambridge Phil. Soc., Vol. 53, Pt 2, 462-72 (April, 1957).

For Pt II, see Abstr. 6715 (1955). It is shown that a combination of the methods developed in earlier papers allows the reformulation of general relativity as a technique for extrapolating physical theory to distant regions, whose accessibility to experiment is limited. General relativity is thus shown to be one of a number of extrapolation theories allowed by the spread theory of Pt II. A.

530.12

3687. A MODEL IN GENERAL RELATIVITY FOR THE INSTANTANEOUS TRANSFORMATION OF A MASSIVE PARTICLE INTO RADIATION. J.L.Synge.
Proc. Roy. Irish Acad. A, Vol. 59, No. 1, 1-13 (Dec., 1957).

An exact solution of the field equations of general relativity is obtained for a point mass instantaneously transforming into radiation. Null coordinates are used in place of the (r,t) coordinates of the Schwarzschild solution. It is suggested that this solution may be of interest in the conversion of fundamental particles into radiation, and also in the conversion of a star into radiation. G.Stephenson

530.12

3688. THE STATIC SPHERICALLY SYMMETRIC SOLUTIONS IN A UNIFIED FIELD THEORY. J.Moffat.
Proc. Cambridge Phil. Soc., Vol. 53, Pt 2, 489-93 (April, 1957).

A brief account is given of the fundamental properties of a new generalization of Einstein's gravitational theory. The field equations are then solved exactly for the case of a static spherically symmetric gravitational and electric field due to a charged particle at rest at the origin of the space-time coordinates. This solution provides information about the gravitational field produced by the electric energy surrounding a charged particle and yields the Coulomb potential field. The solution satisfies the required boundary conditions at infinity, and it reduces to the Schwarzschild solution of general relativity when the charge is zero. A.

530.12 : 531.51

3689. A STATIC GENERALIZATION OF THE EINSTEIN UNIVERSE. L.Ó Raifeartaigh.
Proc. Roy. Soc. A, Vol. 245, No. 1241, 202-12 (1958).

Solutions of the Einstein field equations are found for the problem of a sphere of constant density surrounded by matter of different constant density. The solutions are discussed and particular attention paid to the topology of the surrounding matter. The Schwarzschild, de Sitter, and Einstein solutions emerge as particular cases of the general problem. A.

530.12

3690. MOTION OF A PARTICLE IN EINSTEIN'S UNIFIED FIELD. E.Clauser.
R.C. Accad. Naz. Lincei, Vol. 21, No. 6, 408-16 (Dec., 1956). In Italian.

The Bergmann–Goldberg method of superpotentials is adapted to Einstein's 1953 theory. The equations of motion, derived from the field equations, are given by the vanishing of certain two-dimensional surface integrals. R.A.Newing

530.12

3691. LAW OF MOTION IN EINSTEIN'S LATEST UNIFIED THEORY. E.Clauser.
Nuovo Cimento, Vol. 7, No. 6, 764-88 (March 16, 1958). In Italian.

The equations of motion are obtained from an integral formula previously introduced by the author (see preceding abstract). For a system of two or more particles, expansions involving terms up to c^{-4} give the gravitational and electrostatic attractions, together with a term representing interaction between the gravitational and electromagnetic fields. Terms involving c^{-6} give Lorentz forces, field interactions and self forces. The essential basis of these results is that the electrostatic potential appears as a solution of the equation $\nabla^4 \phi = 0$, and not of Laplace's equation. The results follow from the 1953, but not from the 1950, formulation of Einstein's theory. R.A.Newing

530.145 : 539.17 : 539.18

3692. RECENT ADVANCES IN PHYSICS. D.Park.
Amer. J. Phys., Vol. 26, No. 4, 210-34 (April, 1957).

A selective review of advances in physics in 1957. It deals with (1) parity conservation, (2) discovery of nobelium and new isotopes of fermium and einsteinium, and with (3) catalysis of nuclear fission by μ-mesons.

530.145

3693. HIDDEN VARIABLES IN QUANTUM MECHANICS. I.I.Zinnes.
Amer. J. Phys., Vol. 26, No. 1, 1-4 (Jan., 1958).

The hidden variable theorem due to von Neumann is deduced in a physically transparent manner. As a result it is clear that the theorem is correct only if one requires that these hidden variables merely enlarge the set of observables employed at present in quantum mechanics. The theorem cannot be interpreted to mean that one cannot introduce such additional variables in order (1) to specify a state with classical completeness, and (2) to define the usual observables as statistical parameters. A.

530.145 : 539.12

3694. NON-CONSERVATION OF PARITY. A.Salam.
Nature (London), Vol. 181, 447-9 (Feb. 15, 1958).

This is the report of a symposium organized by the Royal Society and held in London on December 5th, 1957 to review the recent "parity" developments in the field of β-decay, $\pi-\mu-e$ decay and "strange"-particle decay. M.A.Grace

530.145

3695. REMARKS ON PARITY CONSERVATION AND THE TWO-COMPONENT THEORY OF THE NEUTRINO. J.Serpe.
Nuclear Phys., Vol. 4, No. 1, 183-7 (Aug., 1957).

Attention is drawn to a property of the two-component neutrino theory which was established a few years ago by the present author (Abstr. 7043/1952), namely, that this theory is equivalent to Majorana's abbreviated theory. Some comments are made on the particle–antiparticle concept and on the formulation of the β-interaction with the help of the two-component neutrino-field. A.

530.145

3696. CONNECTION BETWEEN LOCAL COMMUTATIVITY AND REGULARITY OF WIGHTMAN FUNCTIONS. F.J.Dyson.
Phys. Rev., Vol. 110, No. 2, 579-81 (April 15, 1958).

It is proved that a Wightman function (vacuum expectation value of a product of field-operators) will be analytic and one valued at a real set of space-time points if and only if the fields possess a property of weak local commutativity at the same points. This statement assumes the validity of T.C.P.-invariance. A similar but more complicated statement is proved for theories without T.C.P.-invariance. A.

530.145

3697. ON THE TWO-COMPONENT NEUTRINO FIELD. T.Takabayasi.
C.R. Acad. Sci. (Paris), Vol. 246, No. 7, 1010-13 (Feb. 17, 1958). In French.

The neutrino equations are written in a non-spinor form, interpretable as the equations for a massless fluid with spin. J.C.Taylor

530.145

3698. PHYSICAL APPLICATIONS OF THE LORENTZ GROUP. B.S.Madhava Rao.
Proc. Indian Acad. Sci. A, Vol. 47, No. 3, 105-15 (March, 1958).

A review of the rôle of Lorentz invariance in the quantum theory of fields and elementary particles. M.J.Kearsley

530.145

3699. ON THE CONVERGENCE OF PERTURBATIVE EXPANSIONS. A.Buccafurri and E.R.Caianello.
Nuovo Cimento, Vol. 8, No. 1, 170-3 (April 1, 1958).

The classical theorem of Arnaldi is used to give a new proof of Yennie's result that the perturbative expansions of the propagation kernels of quantum electrodynamics possess an infinite radius of convergence if the degrees of freedom of the free fermion field are restricted to a finite number of modes, which "shows as clearly the mathematical reason of the holomorphy, and seems better suited to deeper investigations of this subject". P.K.Kabir

530.145

3700. SOME REMARKS ON SELF-ACCELERATION AND SIMILAR EFFECTS IN QUANTUM FIELD THEORY. K.Wildermuth and K.Baumann.
Nuclear Phys., Vol. 3, No. 4, 612-23 (June, 1957).

Some examples of the appearance of self-acceleration effects in quantum field theory are examined. As opposed to the situation in classical theory, it turns out that whenever there are self-acceleration solutions, there are no solutions free from self-acceleration. In order to avoid self-acceleration, the structure of the theory has to be changed fundamentally. The principal change consists in the introduction of acausality. A.

530.145

3701. RENORMALIZATION OF AXIAL VECTOR COUPLING. J.C.Polkinghorne.
Nuovo Cimento, Vol. 8, No. 1, 179-80 (April 1, 1958).

An approximately conserved meson and nucleon axial vector current is constructed. J.C.Taylor

530.145

3702. INVARIANCE PROPERTIES AND IDENTITIES BETWEEN RENORMALIZATION CONSTANTS. A.Petermann.
Nuclear Phys., Vol. 3, No. 4, 592-7 (June, 1957).

The invariance of a given mixture of meson fields under the Stueckelberg transformation — of which the Foldy transformation is a special case — is first briefly recalled. Then, if one requires, for this mixture, the invariance under the charge renormalization group, identities between the renormalization constants are found which are the counter-parts, in meson theory, of the well-known Ward identity in quantum electrodynamics. A.

530.145

3703. SPACE-TIME REFLECTIONS AND ISOBARIC SPIN. J.C.Taylor.
Nuclear Phys., Vol. 3, No. 4, 606-11 (Jan., 1957).

An 8-component spinor representation of the extended Lorentz group is identified with the proton–neutron doublet. Electromagnetic interactions break invariance under Schwinger time-reversal but not Wigner time-reversal. This is analogous to the way in which weak interactions break parity invariance. A similar representation can be assigned to the Λ-particle, if it is a parity doublet. A.

530.145

3704. SYMMETRIES OF THE STRONG INTERACTIONS. A.Pais.
Phys. Rev., Vol. 110, No. 2, 574-8 (April 15, 1958).

An attempt is made to study the symmetry properties of the strong baryon–meson couplings without using arguments concerning the origin of the baryon mass differences. It is shown that too high a symmetry is incompatible with associated production experiments. The argument is independent of perturbation theory. It is assumed that the Σ and Λ have the same spin, that the (Σ,Λ) parity is even, and that the usual isotopic spin assignments are correct. The general conclusions may have to be revised if it would turn out that the commonly assumed baryon spectrum is incomplete. A.

530.145 : 539.12

CHIRALITY INVARIANCE AND THE UNIVERSAL FERMI INTERACTION. See Abstr. 3301

530.145

3705. SIMPLIFIED APPROACH TO SPIN IN DIRAC THEORY. H.Mendlowitz.

Amer. J. Phys., Vol. 26, No. 1, 17-24 (Jan., 1958).

The usual definition of spin in the Dirac theory brings about peculiar results which are difficult to visualize from an intuitive standpoint. An approach to this problem utilizing the framework of the Foldy–Wouthuysen representation is suggested (Abstr. 5526/1950). Applications to the description of polarization of beams and scattering experiments are discussed. A.

530.145

3706. POLARIZATION OF SPIN ONE PARTICLES. S.W.Mac-Dowell.
An. Acad. Brasil. Ciênc., Vol. 28, No. 1, 71-81 (1956).

530.145 : 532.5

3707. QUANTIZED AND STABLE EXCITED STATES OF ROTATING RELATIVISTIC FLUID MASSES. P.Hillion and J.P.Vigier.
C.R. Acad. Sci. (Paris), Vol. 246, No. 4, 564-7 (Jan. 27, 1958). In French.

A three-dimensional description of the motion of a fluid droplet involves the instantaneous angular velocity vector s and the position vector t of the mass centre relative to the matter centre of the droplet. The angular momentum vector is expressed in terms of components p_k and p'_k with respect to frames associated with t and with s. On quantization of the theory, six angular momentum operators corresponding to p_k and p'_k are introduced. Quantization is also interpreted in terms of action variables, and the state of motion of the droplet is determined by the quantum numbers. The droplet is taken to provide a model for a boson, or a fermion, according as the vectors s and t are, or are not, colinear. R.A.Newing

530.145 : 532.5

3708. QUANTIZED AND STABLE EXCITED STATES OF ROTATING RELATIVISTIC FLUID MASSES. P.Hillion, G.Lochak and J.P.Vigier.
C.R. Acad. Sci. (Paris), Vol. 246, No. 5, 710-13 (Feb. 3, 1958). In French.

The previous three-dimensional discussion (see preceding abstract) of the motion of a fluid droplet is extended to Minkowski space–time, the motion being described in terms of angular momentum components in two isotropic hyperplanes associated with the vectors s_μ and t_μ. Angular momentum operators arising on quantization are discussed, and results are interpreted in terms of six first integrals of the equations of motion. R.A.Newing

530.145 : 532.5

3709. A NEW CLASSIFICATION OF THE ELEMENTARY PARTICLES, CONCEIVED AS STABLE EXCITED STATES OF ROTATING RELATIVISTIC FLUID MASSES. P.Hillion, G.Lochak and J.P.Vigier.
C.R. Acad. Sci. (Paris), Vol. 246, No. 6, 896-9 (Feb. 10, 1958). In French.

Eulerian angles, introduced in conjunction with the Lorentz group, provided quantum numbers for the constants of motion of a relativistic rotating drop. They are here used to give a classification of elementary particles, including leptons and photons. S.J.Goldsack

530.145

3710. THE CPT THEOREM IN THE THEORY OF QUANTIZED AND STABLE EXCITED STATES OF ROTATING RELATIVISTIC FLUID MASSES. P.Hillion.
C.R. Acad. Sci. (Paris), Vol. 246, No. 10, 1508-10 (March 10, 1958). In French.

Elementary particles are represented in the theory as distinct states of motion of a rotating fluid droplet. The theory is shown to be invariant with respect to the successive operations of charge conjugation (C), space reflection (P), and time reversal (T), but not with respect to these operations taken separately. R.A.Newing

530.145

3711. A NON-LINEAR THEORY OF PARTICLES OF SPIN 1. Kuo-Hsien Tzou.
C.R. Acad. Sci. (Paris), Vol. 246, No. 12, 1815-17 (March 24, 1958). In French.

A non-linear theory of particles of spin 1, proposed in a previous paper (Abstr. 8995/1957), is made more precise, and its compatibility and applicability are discussed both for the case of charged and of uncharged particles. P.M.Davidson

530.145 : 530.162

3712. STATISTICAL TREATMENT OF THE STRUCTURE OF ELEMENTARY PARTICLES. L.A.Kurtenkov.
Zh. éksper. teor. Fiz., Vol. 33, No. 2(8), 554-5 (1957). In Russian.

Quantum field theory enables one, in principle at least, to compute probability distributions for the position and momentum coordinates of a particle, without however saying anything about its structure. The "intrinsic-structure parameter" can be represented in terms of basic stochastic variables and its distribution calculated. The proposed representation is consistent with the uncertainty principle. J.W.Gardner

530.145

3713. INEQUALITY RELATIONS FOR SCATTERING CROSS SECTIONS. H.Reeves.
Ann. Phys. (New York), Vol. 3, No. 4, 386-96 (April, 1958).

Use is made of a lemma by Erdös and Fuchs to derive various mathematical inequalities applicable to scattering and polarization cross-sections, and the conditions under which they hold. They are compared to inequalities obtained by simpler methods. One possible application of these relations is to check whether a given set of experimental cross-sections obeys these inequalities or not. If it does not, we then know that the corresponding conditions are not fulfilled. The violation of these conditions would provide some information about the interaction. A.

530.145 : 539.12

3714. IMPROVEMENT OF THE BORN APPROXIMATION FOR SCATTERING BY A POTENTIAL WELL OF SPHERICAL SYMMETRY. M.Fabre de la Ripelle.
C.R. Acad. Sci. (Paris), Vol. 246, No. 10, 1511-13 (March 10, 1958). In French.

As the exact solution is known for a spherically symmetric square-well potential, the given potential, supposed negligible beyond a certain range r_0, is replaced by a square-well potential of the same range r_0. By considering the solutions to the differential equation for the l-th partial wave in a well which is the difference between the given and square-well potentials, equations are found giving the best depth for the latter. This well depth depends on the energy of the scattering particle and on the quantum number l, but as the wave number of the scattering particle tends to infinity, the well depths for each partial wave tend to a common limit. The resulting corrections to the phases correspond to a second-order Born approximation. M.J.Kearsley

530.145

3715. NON-LOCAL INTERACTIONS AND THE SCATTERING MATRIX. K.Chadan.
C.R. Acad. Sci. (Paris), Vol. 246, No. 10, 1513-16 (March 10, 1958). In French.

For an interaction consisting of a sum of a local interaction and a separable non-local interaction, it is shown that if the local part is known, the determination of the non-local part from the scattering matrix is analogous to the case where only the non-local interaction is present. Treating the problem in which the local central potential does not possess a bound state, the Schrödinger equation is transformed to momentum space, after introducing spectral functions and Fourier transforms modified for functions of integrable square. For scattering, explicit equations are given for the additional phases due to the separable non-local interaction in the presence of the local interaction. M.J.Kearsley

530.145

3716. AN ADIABATIC SCALAR NEUTRAL MESON–NUCLEON INTERACTION. J.Feldman.
C.R. Acad. Sci. (Paris), Vol. 246, No. 8, 1163-5 (Feb. 24, 1958). In French.

Using a neutral scalar meson theory without recoil and with adiabatic switching on of the interaction, the vacuum–vacuum amplitude without renormalization is derived. G.H.Burkhardt

530.145 : 539.12

3717. OBSERVATION ON THE DISPERSION RELATIONS FOR SCATTERING OF PIONS BY NUCLEONS. B.M.Stepanov.
Dokl. Akad. Nauk SSSR, Vol. 118, No. 5, 911-12 (1958). In Russian.

The S-matrix for the pion–nucleon system is conveniently formulated in terms of the interaction representation. The dispersion relations then follow from the usual prescription, but with rather less manipulation since functional integration is avoided. J.W.Gardner

530.145

3718. APPROXIMATION METHODS FOR THE STUDY OF THE PION–NUCLEON DISTRIBUTION IN THE S-WAVE. M.Bassetti.
Nuovo Cimento, Vol. 8, No. 2, 361-2 (April 16, 1958). In Italian.

It is shown that the solution proposed by Lomon (Abstr. 6362/1956) has to be considered only as an approximation. P.Roman

530.145

3719. ON A VARIATIONAL PRINCIPLE IN THE MANY-BODY PROBLEM. N.N.Bogolyubov.
Dokl. Akad. Nauk SSSR, Vol. 119, No. 2, 244-6 (1958). In Russian.

The variational principle is formulated in terms of the commutator of the many-particle variables; the limitations thereby imposed on the particle Hamiltonian are discussed for fermions.

J.W.Gardner

530.145

3720. THE SOLUTIONS OF THE LOW EQUATION. I.
D.B.Fairlie and J.C.Polkinghorne.
Nuovo Cimento, Vol. 8, No. 2, 345-9 (April 16, 1958).

The connection between the manifold of solutions of the Low equations for a non-relativistic system and the existence of "hidden structure" is exhibited. A.

530.145 : 539.12

3721. EFFECTIVE RADIUS OF MANY-BODY FORCES BETWEEN A^0-HYPERON AND NUCLEONS. V.I.Ogievetskii.
Zh. éksper. teor. Fiz., Vol. 33, No. 2(8), 546-7 (1957). In Russian.

Discusses several many-body reactions involving hyperons, nucleons and, intermediately, mesons. An exponential many-body law of force is proposed for which the effective radius varies inversely as the number and masses of the interacting particles.

J.W.Gardner

530.145

3722. ANALYSIS OF THE SCHRÖDINGER ENERGY SERIES. E.Feenberg.
Ann. Phys. (New York), Vol. 3, No. 3, 292-303 (March, 1958).

The rate of convergence of the Brillouin–Wigner and Schrödinger energy series can be modified by using elements of freedom present in the formulation of the perturbation problem. Two such elements of freedom are (a) a uniform displacement of the zeroth order energy spectrum and (b) a uniform change of scale in the spacing of the zeroth order energy levels. Transformation a is used to generate the Schrödinger energy series from the corresponding Brillouin–Wigner series. The effect of transformation b on the former series is worked out and exhibited explicitly. The problem of defining a criterion for determining the scale factor is by-passed by the observation that continued fraction approximants to the Schrödinger energy series are invariant under transformation b. Explicit formulae are given for the first three invariant forms. A.

530.145

3723. THE USE OF PROJECTION OPERATORS IN THE CONFIGURATION INTERACTION PROBLEM. R.K.Nesbet.
Ann. Phys. (New York), Vol. 3, No. 4, 397-407 (April, 1958).

Matrix elements of the many-particle Hamiltonian, for atomic, molecular, or nuclear wave-function calculations, can be reduced from quadratic to linear forms by the use of totally antisymmetric basis functions which result from applying projection operators to single determinants. The projection operators select components with definite transformation properties under symmetry operations of the invariance group of the Hamiltonian. It is shown that the projected functions need to be known only up to an undetermined numerical factor in order to determine matrix elements between the corresponding normalized functions. A method is given for constructing such projected determinants from any orthonormal set of totally antisymmetric functions with the same transformation properties under the symmetry group. To complete the presentation of a self-contained, practicable, and reasonably efficient method for evaluating the general configuration interaction matrix element, a minimal set of linear equations are stated which determine the transformation coefficients that completely reduce the representation of an arbitrary symmetry group. A.

530.145 : 518.5

3724. SOLUTION OF THE SCHRÖDINGER EQUATION FOR THE VAN DER WAALS POTENTIAL.
A.Bączynski, W.Berdowski and S.Łęgowski.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 6, No. 2, 119-25 (1958).

The apparatus devised by Antonowicz (Abstr. 5207/1954, 6382/1956) for integrating the Schrödinger wave equation was improved and applied to the case of a van der Waals potential.

P.M.Davidson

530.145

3725. EXPANSION OF THE REGULAR COULOMB WAVE FUNCTION IN TERMS OF BESSEL FUNCTIONS. A.S.Meligy.
Proc. Phys. Soc., Vol. 71, Pt 5, 856-8 (May, 1958).

The regular radial Coulomb wave-function is first expressed in terms of the confluent hypergeometric function. Representing the latter by a contour integral and integrating the expansion of its intergrand, term by term, enables the Coulomb wave-function to be expressed finally in terms of Bessel functions of integral order. The expansion is particularly convenient for computation of the wave-functions at high energies. M.J.Kearsley

530.145

3726. ON THE EIGENVALUES IN PROBLEMS WITH SPHERICAL SYMMETRY. E.C.Titchmarsh.
Proc. Roy. Soc. A, Vol. 245, No. 1241, 147-55 (1958).

It is shown that the eigenvalues associated with the equation $\nabla^2\psi + \{\lambda - q(r)\} = 0$, where $q(r)$ is a function of r only and tends to infinity as $r \to \infty$, are the roots of equations of the form

$$\int_0^R \{\lambda - q(r)\}^{1/2} dr = (\tfrac{1}{2}l + n + \tfrac{3}{4})\pi + \delta_n$$

where l and n are integers, and δ_n is small when n is large.

A.

530.145

3727. ON THE RELATION BETWEEN "ACCIDENTAL" DEGENERATION AND "LATENT" SYMMETRY OF A SYSTEM. S.P.Alliluev.
Zh. éksper. teor. Fiz., Vol. 33, No. 1(7), 200-3 (1957). In Russian.

An example is considered which confirms the connection between "accidental" degeneration and "latent" symmetry of a system. The symmetry of a two-dimensional oscillator is investigated and a connection established between quantization of the oscillator and quantization of an operator of the angular momentum type. A.

530.15

3728. ON THE CLASSICAL LAWS OF MOTION. L.Eisenbud.
Amer. J. Phys., Vol. 26, No. 3, 144-59 (March, 1958).

A number of logical objections may be raised against the classical laws of motion as they were formulated by Newton and as they are usually presented in textbooks of physics. These objections are reviewed, and a reformulation of the basic laws of motion is suggested to bring out the essential significance of the mass and force concepts. A.

530.152.1

3729. ON THE ORIGIN OF INERTIA. N.S.Rasor.
Amer. J. Phys., Vol. 26, No. 3, 188-9 (March, 1958).

An intuitive concept of the origin of physical inertia is illustrated by elementary semiquantitative calculations. Physical situations for which the concept predicts departure from the second law of motion are discussed. A

530.16

3730. RANDOM TIME. N.Wiener and A.Wintner.
Nature (London), Vol. 181, 561-2 (Feb. 22, 1958).

It is suggested that "time" can be defined only in terms of measurements subject to statistical fluctuations. The present note gives the harmonic analysis of a simple model of the statistical fluctuations of time. R.A.Newing

530.161

3731. IRREVERSIBLE PROCESSES IN PHYSICAL THEORY. R.C.L.Bosworth; K.R.Popper.
Nature (London), Vol. 181, 402, 402-3 (Feb. 8, 1958).

See Abstr. 7623/1957. In Bosworth's communication, the concept is equated with the statistical nature of observables: in Popper's, reversibility is considered as too improbable. The discussion is related to Eddington's concept of "Time's Arrow".

P.Gray

530.162

3732. STATISTICAL WEIGHT OF A SYSTEM OF PARTICLES WITH ARBITRARY SPINS. V.S.Barashenkov and B.M.Barbashev.
Nuovo Cimento Suppl., Vol. 7, No. 1, 19-24 (1958).

These are tabulated for systems of particles with spins of $\frac{1}{2}$, 1 or $\frac{3}{2}$. J.C.Taylor

530.162

3733. THERMAL FLUCTUATIONS IN A NONLINEAR SYSTEM. N.G.van Kampen.
Phys. Rev., Vol. 110, No. 2, 319-23 (April 15, 1958).

An an example of a nonlinear system, an electric circuit containing a voltage-dependent resistance R(V) is studied. The resistance is in contact with a heat bath and generates current fluctuations. A general method is given to find the spectral density of these fluctuations. For two special forms of R(V), explicit results are obtained by means of a perturbation calculation. The result differs from the Nyquist formula mainly in that new terms appear, corresponding to relaxation times $\frac{1}{2}R_0C$, $\frac{1}{3}R_0C$, etc. A.

530.162

3734. A NOTE ON THE SYSTEMATIC INTEGRATION OF KRAMERS' EQUATION FOR BROWNIAN MOTION IN A FIELD OF FORCE. R.O.Davies.
Physica, Vol. 23, No. 11, 1067-8 (Nov., 1957).

A simplified derivation of recurrence relations due to Brinkman (Abstr. 8439/1957) which formally solve Kramers' equation subject to a given initial space distribution. The lowest of these gives a modified and "corrected" form of the Smoluchowski equation in coordinate space. R.O.Davies

MECHANICS OF SOLIDS

531.1

3735. SOME NOTES ON NEWTON'S SECOND LAW OF MOTION. B.Saelman.
Amer. J. Phys., Vol. 25, No. 8, 584-5 (Nov., 1957).

The problem of the motion of a water cart, moving under the impulse of a water jet and accumulating water, is used to show that with the equation F = d(Mv)/dt care must be taken to express all terms with respect to a common frame of reference.

S.Weintroub

531.2

3736. THEORY FOR SIMPLE MACHINES. H.C.Jensen.
Amer. J. Phys., Vol. 25, No. 9, 599-602 (Dec., 1957).

A theory is presented for a simple machine that gives a relationship between the efficiency and the load lifted by the machine. The theory is shown to be valid for data taken from a pulley system.

A.

531.224.8

3737. STATICS AND DYNAMICS OF A HELICAL SPRING. R.Geballe.
Amer. J. Phys., Vol. 26, No. 5, 287-90 (May, 1958).

The theory of the extension and twisting of a helical spring was given in a recent paper by Krebs and Weidlich (Abstr. 3145/1954). This theory is reviewed and its applicability as an experiment in advanced mechanics is described. From measurements of extension and twisting under static load, and also from simple observation of the coupled oscillations of these degrees of freedom, it is possible to calculate Poisson's ratio and the shear modulus. The two independent procedures give consistent results. The experiment provides an excellent demonstration of the geometry and elastic deformation of a helix, its static equilibrium and its coupled oscillations. A.

531.25 : 535.55

3738. A RAPID METHOD FOR SEPARATING THE PRINCIPAL STRESSES IN PLANE PHOTOELASTICITY. I.Brodie.
Brit. J. appl. Phys., Vol. 9, No. 5, 201-3 (May, 1958).

531.3

3739. THEORY OF THE RELATIVISTIC OSCILLATOR. L.A.MacColl.
Amer. J. Phys., Vol. 25, No. 8, 535-8 (Nov., 1957).

This is a study of the motions of a particle subject to the restoring force exerted by a linear spring, under the assumption that the mass depends upon the speed according to the formula given by the theory of special relativity. A.

531.3 : 518.43 : 621-52

3740. PHASE-PLANE GRAPHICS — A NEW APPROACH TO TEACHING DYNAMICS. L.S.Packer and N.S.Eiss.
Amer. J. Phys., Vol. 26, No. 2, 91-103 (Feb., 1958).

The theory of the phase-plane is briefly presented and three basic phase-plane trajectories are derived. Graphical analyses on the phase-plane is proposed as a teaching aid for undergraduate courses in mechanics and vibration. The laws of elementary impact are reviewed and a concise phase-plane representation of impact is derived from the impact equations. The phase-plane method is used to study the motion resulting from the impact between two equal period pendulums of 3 : 1 mass ratio. Advantages of the phase-plane representation of impact are cited. The basic phase-plane trajectories derived are used as components of exact phase-plane representations of various discontinuous motions, such as dissipative impact of two mass particles and dissipative bouncing. A.

531.383

3741. THE RISING OF TOPS WITH ROUNDED PEGS. D.G.Parkyn.
Physica, Vol. 24, No. 5, 313-30 (May, 1958).

The perturbing effect of a general system of forces is calculated for a rolling and for a sliding top, and it is shown that certain components by virtue of their dependence upon the spin will be principally effective in erecting the top. For a sliding top the principal component is the sliding friction, and for a rolling top a couple at the point of contact opposing rolling. Experimental results on tops are analysed and it is shown, in accordance with a conjecture of Fokker, that a normal top does remain effectively in the rolling configuration but the motion is not in general one of pure rolling, since periodic sliding oscillations occur which profoundly modify the motion. The rate of rise in pure rolling gives a value of the rolling couple of the order of 3000 dyne cm. A.

531.51

3742. DEMONSTRATION OF GRAVITATIONAL ATTRACTION WITH THE CAVENDISH BALANCE. H.Meissner.
Amer. J. Phys., Vol. 25, No. 9, 639-40 (Dec., 1957).

A Cavendish balance is described, which has a period of 3.5 min and gives a deflection of the light beam of 3 mm at a distance of 1 m when the position of the outer spheres is changed. This deflection is read with a pair of photocells which, driving a cathode follower, give a current of 44 μA or more, depending on the valve used for the cathode follower. The current can be read with a projection meter. The damping of the balance can be adjusted between critical damping and almost zero. A.

531.55 : 623.451.8

3743. OPTIMUM PAY-LOAD-RATIO RELATION FOR MULTIPLE-STAGE ROCKETS. G.Leitmann.
Amer. J. Phys., Vol. 26, No. 1, 28-30 (Jan., 1958).

The principle of the multiple-stage rocket is reviewed. It is shown that the burn-out velocity of a multiple-stage rocket is higher than that of a single-stage rocket of the same over-all mass ratio. It is also shown that the over-all pay-load ratio of a multiple-stage rocket required to reach a given velocity is a minimum when the pay-load ratios of all stages are equal. Departure from this equality is demonstrated to have little effect on the over-all pay-load ratio. A.

531.576

3744. HIGH-VELOCITY, LIGHT-GAS GUN. W.D.Crozier and W.Hume.
J. appl. Phys., Vol. 28, No. 8, 892-4 (Aug., 1957).

A new range of muzzle velocities was achieved by propelling a projectile in a gun barrel by a column of hydrogen or helium instead of the conventional powder gas. The first gun built, the design of which probably was far from optimum, yielded muzzle velocities in excess of 12 000 ft/sec with spherical and cylindrical steel projectiles. A.

531.66

3745. STUDY OF COLLISIONS. I. A SURVEY OF THE PERIODICAL LITERATURE. G.Barnes.
Amer. J. Phys., Vol. 26, No. 1, 5-8 (Jan., 1958).

A review of the periodical literature on the subject of impact and the coefficient of restitution shows that the latter depends not only on the materials (elastic moduli) of the colliding objects, but also on (1) their relative normal velocity at the instant of impact, (2) their shapes and sizes, (3) their masses, and (4) the medium in which the impact occurs. A.

531.66

3746. STUDY OF COLLISIONS. II. SURVEY OF THE TEXTBOOKS. G.Barnes.
Amer. J. Phys., Vol. 26, No. 1, 9-12 (Jan., 1958).

A survey of physics and engineering textbooks and periodicals indicates that there is lack of agreement on the subject of impact and the coefficient of restitution. The confusion arises primarily because of (1) the way in which the coefficient of restitution is so often defined, (2) the nature of the usual discussions of it, and (3) the

reason given for its being less than unity for most collisions between objects of ordinary size. Ways of eliminating the difficulty are discussed. A.

531.662

3747. CLASSIFICATION OF COLLISIONS; ELASTIC COLLISIONS ON A MACROSCOPIC SCALE.
G.Barnes, J.W.Patmore and S.J.Fountain.
Amer. J. Phys., Vol. 26, No. 2, 122-7 (Feb., 1958).

Although a number of well-known physics textbooks imply, and some state definitely, that perfectly elastic collisions never occur, it is pointed out here that collisions between atoms and molecules are frequently elastic. A classification of collisions into three groups, depending upon the nature of the interaction forces, indicates that certain kinds of collisions between macroscopic objects may be perfectly elastic. Simple laboratory experiments illustrating two of these cases are described. A.

MECHANICAL MEASUREMENTS

531.714 : 539.382

A LATERAL EXTENSOMETER FOR THE DETERMINATION OF POISSON'S RATIO OF ROCK. See Abstr. 3519

531.714.1 : 537.224 : 621.317.39

3748. A SENSITIVE MICROMETER FOR MEASURING SMALL DISPLACEMENTS. J.Norbury and D.Shewring.
J. sci. Instrum., Vol. 35, No. 6, 217-20 (June, 1958).

A variable parallel-plate capacitor associated with an oscillating circuit forms the basis of an apparatus which can measure displacements of the order of 200 A. The apparatus is so designed as to combine robustness with sensitivity, ease of calibration and reproducibility. The use of a diode pump integrator circuit makes the sensitivity independent of the gain of the a.c. amplifier. The capacitor is of simple construction and standard electronic components are used throughout. A.

531.715.1/.2 : 535.417

3749. SYMPOSIUM ON OPTICAL AND SURFACE METHODS OF NON-DESTRUCTIVE TESTING.
S.Tolansky; R.W.B.Stephens; O.S.Heavens.
Brit. J. appl. Phys., Suppl. No. 6 (Physics of non-destructive testing), S5-S9, S9-S10, S10-S12 (1957).

I. Tolansky reviews the optical methods used in his laboratory for the examination of micro-structures of metal surfaces. The methods described are two-beam interferometry, multiple-beam interferometry, the light-profile microscope, optical shadow casting and the total reflection contact method. The usefulness and limitation of each method are discussed. Examples of the application of each method are given.

II. Stephens briefly discusses the various types of optical measurement which might be applied to the examination of surfaces. Consideration is given to the possible use for specific problems of the u.v., the visible, the i.r. and the microwave regions of the electromagnetic spectrum.

III. Heavens presents a brief survey of the type of information which may be obtained by the application of optical methods to the study of the surfaces of materials. Consideration is restricted to the kind of method which is likely to be of use as a non-destructive test. A.

531.717 : 536.212.2

THERMAL COMPARATOR FOR MEASUREMENT OF SURFACE ROUGHNESS AND THICKNESS OF FOILS. See Abstr. 3022

531.76

3750. AN ACCURATE TIMING DEVICE FOR A LOW-FREQUENCY PENDULUM. E.W.Dickson and N.Thorley.
Proc. Univ. Durham Phil. Soc. A, Vol. 13, No. 5, 33-40 (1957).

The device consists of a modified phonic chronometer. Full details of the circuit are given and the use of the device is described for the measurement of the period (~ 3.33 sec) of a torsional pendulum and its variation with the amplitude of the freely decaying oscillations. The maximum error is stated to be ± 0.5 msec. S.Weintroub

531.781 : 539.383

THE EFFECT OF SPECIMEN DIAMETER ON THE STRAINING OF A CYLINDRICAL LOAD-CELL. See Abstr. 3520

MECHANICS OF FLUIDS

532.13 : 537.228

3751. A NEW VISCOELECTRIC EFFECT. J.Hart.
Physica, Vol. 23, No. 8, 795-6 (Aug., 1957).

The viscosity of a polar semi-insulating liquid, such as chlorobenzene, apparently increases when a constant electric field is applied transversely to the direction of flow. This large change in viscosity decreases and eventually vanishes as the frequency of the applied field is increased. However, n-amyl acetate shows a new effect; there are a number of viscosity peaks, of which the position and magnitude are determined by the flow rate of the liquid between the electrodes of the viscometer. At certain flow rates the viscosity falls below the normal value. A.E.Kay

532.133 : 532.14

3752. VISCOSITY AND DENSITY OF LIQUID METALS. S.S.Mitra
Physica, Vol. 24, No. 2, 155-6 (Feb., 1958).

It is shown that the measured viscosities (η) and densities (ρ) of calcium, magnesium, indium and tin are very well represented by the formula $(\eta/\rho)^{1/3} = a + b/T$, where a and b are constants and T is temperature. R.O.Davies

532.133 : 532.7

BULK VISCOSITY IN LIQUIDS. See Abstr. 2846-7

532.137

3753. A COMPENSATED MOVING CYLINDER VISCOMETER.
G.M.Sreekantath and C.A.Verghese.
J. sci. Instrum., Vol. 35, No. 5, 160-1 (May, 1958).

Based on the principle of Lawaczeck's falling cylinder viscometer, a new viscometer was designed, in which the only measurement to be made is the time taken by the cylinder to move a definite distance, without the necessity of either observing the movement of the cylinder or measuring the densities of the cylinder and of the liquid. The instrument consists of two exactly similar, light, solid cylinders, or cylindrical bulbs, moving in similar vertical tubes of slightly larger diameters containing the liquid at the same temperature. The ends of each cylinder are made conical to ensure its coaxial movement in the tube and the cylinders are attached to the ends of a nylon fibre, which passes over a light frictionless pulley. Attached to the same fibre at suitable heights above the cylinders are two similar light-weight carriers on either of which riders of equal mass may be placed. When a certain number of riders are placed on one side, the cylinder on that side moves down, while the other cylinder moves up with uniform speed, the pulley revolving once in a time T, which is directly proportional to the viscosity of the liquid. This result may be used to compare the viscosities η_1 and η_2 of two liquids using the same number of riders and noting the times T_1 and T_2 respectively for a complete rotation of the pulley. $\eta_1/\eta_2 = T_1/T_2$. The instrument is capable of high accuracy and has the special feature that a knowledge of the density of the liquid is not needed in the calculation of the result. A.

532.137

3754. ROTATION VISCOMETER DIRECTLY MEASURING THE RATIO OF THE SHEARING STRESS TO THE RATE OF SHEAR.
H.Eisenberg.
Rev. sci. Instrum., Vol. 28, No. 11, 927-9 (Nov., 1957).

The reading, for Newtonian liquids, is independent of the speed of rotation and, for non-Newtonian liquids, gives a direct indication of the dependence of the apparent viscosity on the rate of shear. The principle of the measurement is as follows. A slit, the width of which is proportional to the shearing stress, rotates together with the rotating cylinder of the viscometer; a narrow beam of light passes through this slit and falls on a photoelectric cell; the time of illumination of the photoelectric cell is proportional to the viscosity. The instrument may be used over a wide range of viscosities and rates of shear. A.

532.516

3755. VISCOUS FLOWS PAST A SPHEROID. S.Wakiya.
J. Phys. Soc. Japan, Vol. 12, No. 10, 1130-41 (Oct., 1957).

A solution of the Stokes equations of motion of a viscous fluid is given in a form suitable for dealing with flow past an ellipsoid. When the ellipsoid has rotational symmetry, the solution is expressed in infinite triple integrals. By utilizing these results, two kinds of steady flow of a viscous fluid past a spheroid are studied when the direction of the main stream is parallel to the axis of symmetry of the spheroid. The first is the flow past a spheroid between two parallel plane walls; the second is the flow past a spheroid in a cylindrical pipe, with its axis of revolution along the axis of the pipe

particular, the drag and the moment acting on the spheroid, as ell as the pressure drop in the pipe, are discussed in detail. The oment of force acting on a spheroid moving uniformly between two rallel walls changes its sign when the curvature of the spheroid ceeds a certain definite value. A.

532.517

56. LIQUID ROPE-COIL EFFECT. G.Barnes and R.Woodcock.
ner. J. Phys., Vol. 26, No. 4, 205-9 (April, 1958).

The tendency for a falling stream of very viscous liquid to coil e a rope when it strikes a horizontal surface is studied and the ilding of a "cone" of liquid of considerable height above the surface observed. It is shown that, although the liquid stream as a whole pears to rotate about the axis of the "cone", the particles of liquid not actually rotate about this axis. Variations of the liquid rope-il effect are discussed. A.

532.517

57. NON-NEWTONIAN EFFECTS IN STEADY MOTION OF OME IDEALIZED ELASTICO-VISCOUS LIQUIDS. J.G.Oldroyd.
roc. Roy. Soc. A, Vol. 245, No. 1241, 278-97 (1958).

Normal-stress effects and the variation of apparent viscosity th rate of shear in simple types of steady flow of certain idealized astico-viscous liquids are discussed. The liquids are those whose haviour at sufficiently small variable shear stresses can be aracterized by three constants (a coefficient of viscosity, a re-xation time and a retardation time) and whose invariant differential uations of state for general motion (involving eight independent ysical constants) are linear in the stresses and include terms of higher degree than the second in the stresses and velocity grad-nt together. The normal stresses which, in addition to shear resses, are present in such a liquid in a state of simple shearing w, or in flow in a circular pipe, or between rotating cylinders, e investigated; and the conditions under which the Weissenberg imbing effect will occur, in a positive or negative sense, are amined. In many liquids of this class, steady rectilinear flow under uniform pressure gradient is not always possible in a straight pipe arbitrary section, nor is steady flow in horizontal circles in a gion bounded by arbitrary surfaces of revolution in relative rotat-n about common vertical axis. The behaviour of these idealized uids when sheared in a narrow gap between a rotating wide-angled ne and a flat plate is compared with the observations of Roberts 952, 1953) on some real elastico-viscous liquids. Certain liquids this class, characterized by six independent constants satisfying rtain inequalities, exhibit rheological behaviour which is, at least alitatively, similar to the behaviour of many real elastico-scous liquids in the following respects: the behaviour at small riable shear stresses, the variation of apparent viscosity with rate steady shearing, the climbing effect up a vertical rod rotated in e liquid, and a distribution of normal stresses equivalent to an tra tension along the streamlines (with an isotropic state of stress the plane normal to the streamlines) which is present in all the mple types of steady shearing flow investigated. These liquids can w steadily in straight lines through a straight pipe of any section. A.

532.517.2

58. USE OF AN ANALOGUE TO RESOLVE STOKES'S ARADOX. R.V.Southwell.
ature (London), Vol. 181, 1257-8 (May 3, 1958).

In the absence of body forces, the equations governing steady minar motion, for very small velocities, are of the same form as e plate-flexure equation when the surface-intensity of the trans-rse loading is zero. By identifying the stream function with the splacement of a bent elastic plate, a solution of the flexural uation yields a hydrodynamical solution. Use of this analogue ows that Stokes's postulates for slow flow past a cylinder are admissible. M.J.Kearsley

532.517.4

59. EXPERIMENTAL STUDIES ON LAMINAR SUB-LAYER IN RBULENT BOUNDARY LAYER INVOLVING SEPARATION.
Shigemitsu.
Phys. Soc. Japan, Vol. 12, No. 2, 183-90 (Feb., 1957).

Observations were made on the mean and fluctuational ocities of the flow near a wall in a turbulent boundary layer ving a non-zero pressure gradient. The edge of the sub-layer s defined as the maximum point of the u-distribution curve. The sults obtained are as follows (suffixes 1 and 0 denote the values the edge of the sub-layer and just outside the boundary layer): in a field with constant pressure the curves of $\bar{U}/\bar{U}_1$ versus y/δ_1 similar to those in the field with a fixed value of $\bar{U}_1\delta_1/\nu$ equal to about 165, indicating that the well-known relation between $\bar{U}/U_\tau$ and yU_τ/ν holds near the wall (U_τ being the frictional velocity); (2) the curve of $\bar{U}/\bar{U}_1$ varies in such a manner that $\partial^2(\bar{U}/\bar{U}_1)/\partial(y/\delta_1)^2$ increases with dP_0/dx near the wall; (3) the laminar sub-layer persists until the boundary layer separates and the separation of the sub-layer seems to be equivalent to turbulent separation phenomenon. A.

532.517.4

3760. TURBULENCE MEASUREMENT IN ELECTRICALLY CONDUCTING FLUIDS. S.Eskinazi.
Phys. of Fluids, Vol. 1, No. 2, 161-2 (March-April, 1958).

Mean and turbulent velocities in a fluid were determined by measuring the resistance across a small gap (0.01 to 0.03 in.) between two point electrodes placed in the fluid. Fluid velocity distorts the electrical path and changes in velocity can therefore be detected by measuring resistance changes. It is suggested that the method could be applied to ionized gases. T.C.Toye

532.52 : 535.551

OPTICAL METHOD FOR ANALYSIS OF FLUID MOTION.
See Abstr. 3008

532.528 : 534.321.9

3761. THE MECHANISM OF CAVITATIONAL BREAK-UP OF SURFACE FILMS IN A SOUND FIELD.
A.S.Bebchuk, L.O.Makarov and L.D.Rozenberg.
Akust. Zh., Vol. 2, No. 2, 113-117 (April-June, 1956). In Russian.

An investigation of the underlying mechanism of ultrasonic cleaning processes. As a standard film, a blob of resin was used, on a glass plate inclined at an angle above the brass termination of a Ni tube excited ultrasonically by an 8 kW generator. The plate and the upper end of the tube were contained in a parallel-sided glass vessel of distilled water. The plate was photographed at 4000 frames/sec. Two phenomena are involved in the break-up of the film: (1) Bubbles bursting near the surface appear to be associated with strong local break-up. (2) Bubbles penetrate under the film and then break it off. C.R.S.Manders

532.528 : 534.321.9

3762. THE MECHANISM OF ULTRASONIC CLEANING.
L.O.Makarov and L.D.Rozenberg.
Akust. Zh., Vol. 3, No. 4, 374-6 (1957). In Russian.

In an earlier paper (preceding abstract) the authors put forward evidence of two mechanisms of ultrasonic cleaning. The present paper gives the results of some high-speed cine-camera studies in support of the second mechanism. C.R.S.Manders

532.57 : 621.317.79

3763. D.C. MAGNETIC FLOWMETER FOR LIQUID SODIUM LOOPS. C.G.Pfister and R.J.Dunham.
Nucleonics, Vol. 15, No. 10, 122-4 (Oct., 1957).

The construction and calibration are described of a flowmeter for measurement of flow rates of 3000 gal/min at 850° F. At low temperatures, eddy currents cause errors of up to 3% at high flow rates. R.D.Smith

532.612.4 : 536.49

3764. INCREASE OF SURFACE TENSION OF CERTAIN SOLUTIONS WHEN BROUGHT INTO CONTACT WITH HOT GASES. N.Skogen.
Amer. J. Phys., Vol. 26, No. 1, 25-7 (Jan., 1958).

The effect may be demonstrated by a flame of coal gas directed toward a surface of a soap solution. A rapid flow of surface layer toward the flame, a surface elevation of several millimeters, and a downward current under the elevation will occur. Rough measurements of the tension by means of drop methods (1) at room conditions and (2) near a flame show an increase from 29 to 57 dyn/cm for a certain solution. The effect of the hot gases may be to restore the conditions of the surface to those of clean water. A.

532.63

3765. MEASUREMENT OF THE CAPILLARY CURVE. D.F.Dempsey.
Amer. J. Phys., Vol. 26, No. 2, 89-90 (Feb., 1958).

The surface of a liquid in contact with a plane wall has a shape which can be obtained by integrating the differential equation of capillarity. Measurements give good agreement with the theory. A.

532.65 : 534.321.9

3766. ULTRASONIC FOG PRODUCED IN MOLTEN METALS. B.Carlin.
J. Acoust. Soc. Amer., Vol. 30, No. 2, 153-4 (Feb., 1958).

Ultrasonic fountains and fogs produced in liquids are not

restricted to those of low boiling point. Experiments with magneto-strictively activated solder baths have demonstrated the production of fountains from 0.75 to 1 in. high. With increased power these fountains broke up into a fog of small solder droplets, resulting in rapid expulsion of the solder from the pot. The power required with 0.5 in. depth of liquid was only of the order of 250 W.

T.C.Toye

MOLECULAR THEORY OF LIQUIDS

532.7

3767. STRETCHING VIBRATIONS IN CONDENSED SYSTEMS: ESPECIALLY BONDS CONTAINING HYDROGEN.
A.M.Benson, Jr and H.G.Drickamer.
J. chem. Phys., Vol. 27, No. 5, 1164-74 (Nov., 1957).

A study is made of the stretching vibrations of a variety of bonds, mostly containing hydrogen, in condensed systems. In particular, measurements were made of vapour–liquid shifts and of the shifts with pressure to 10 000 atm. From the results, an attempt has been made to estimate the relative importance of dispersion, induction, orientation, and repulsion (overlap) energies. The importance of the redistribution of electrons in a molecule due to the varying electronegativity of its constituent parts is particularly noted. A.

532.7 : 536.222

3768. TRANSPORT OF ENERGY AND MOMENTUM IN A DENSE FLUID OF HARD SPHERES. H.C.Longuet-Higgins and J.P.Valleau.
Disc. Faraday Soc., No. 22, 47-53 (1956).

A simplified kinetic theory of the hard-sphere fluid is described. From certain simplifying assumptions about the pair distribution function, expressions are derived for the shear viscosity, bulk viscosity and thermal conductivity at high densities as functions of the temperature, pressure, particle radius and particle mass. These expressions, modified to take account of attractive forces, are compared with published experimental data on monatomic and diatomic fluids. Agreement is only moderate, but improves with increasing density. The theory leads to the relation

$$\frac{\text{shear viscosity}}{\text{thermal conductivity}} = \frac{2}{5} \times \frac{\text{particle mass}}{\text{Boltzmann's constant}},$$

which applies with reasonable accuracy for liquid argon and liquid nitrogen. A.

532.7

3769. LIQUID PAIR DISTRIBUTION. G.H.A.Cole.
J. chem. Phys., Vol. 28, No. 5, 912-17 (May, 1958).

A second-order differential equation is derived which has for its solution the molecular pair distribution for a classical condensed system of particles. When applied to spherical particles interacting with central forces the equation becomes particularly simple and its solution procedure should prove more amenable than that for the equivalent integro-differential equations used by previous authors. This simpler situation will greatly facilitate the consideration of a range of thermodynamic conditions or different systems. The method should in addition lead to greater accuracy in the determination of the pair distribution. A.

532.72

3770. DIFFUSION MEASUREMENTS BY A SAMPLING TECHNIQUE. P.H.Elworthy.
J. sci. Instrum., Vol. 35, No. 3, 102-3 (March, 1958).

An apparatus was devised for measuring diffusion coefficients by withdrawing a small sample of the diffusion column and analysing it. The errors normally present in layer analysis methods were minimized. Provided the volume of the sample was kept within certain limits, and the rate of withdrawal was slow, diffusion coefficients could be measured accurately. The determination of diffusion coefficients of various substances gave values which agreed excellently with known values. The method was precise to 0.4%. A.

532.72 : 539.378.3 : 518.5 : 681.142 : 621.317.79

3771. NEW INTEGRATING CIRCUIT AND ELECTRICAL ANALOG FOR TRANSIENT DIFFUSION AND FLOW. J.R.Macdonald.
Rev. sci. Instrum., Vol. 28, No. 11, 924-6 (Nov., 1957).

A circuit for the electrical simulation of transient diffusion and flow of material between two volumes is described. It allows such processes to be simulated even when forward and reverse transfer rates between the two volumes are unequal. When the reverse rate is zero, the circuit functions as a very-high-input-impedance integrator of wide dynamic range and high accuracy. The circuit will integrate the current through a given resistor, even when this resistor is time-varying or non-linear. For voltage integration, it can have a minimum input impedance approaching 10^9 ohms.

A.

532.739.2

3772. THE SOLUBILITY OF MERCURY IN GASES AT MODERATE PRESSURES. W.B.Jepson, M.J.Richardson and J.S.Rowlinson.
Trans Faraday Soc., Vol. 53, Pt 12, 1586-91 (Dec., 1957).

The concentration of mercury in the gas phase when liquid mercury is in equilibrium with propane and n-butane was measured at pressures up to 30 atm, from 184° to 256°C. These concentrations are up to 35% greater than the concentration in pure mercury vapour at the same temperature. The rate of diffusion of mercury through these gases was measured at the highest temperature. These results confirm previous calculations which showed that this increase in the mercury concentration must affect adversely the accuracy of gas isotherms measured in the presence of mercury. A.

532.74 : 534.22

3773. INTERMOLECULAR FREE LENGTH IN LIQUIDS IN RELATION TO SOUND VELOCITY. O.Nomoto.
J. Phys. Soc. Japan, Vol. 12, No. 6, 739 (June, 1957).

Jacobson's (Abstr. 5614/1952) relation $\beta = kL^p$ (where L = intermolecular free length and p and k are constants with $p \cong 2$ if β is the adiabatic compressibility) leads to a relation $VL\rho^{1/p} =$ = const. = K. Using Eyring's liquid model K has been calculated by Wada (Abstr. 802/1955) but the value equals twice the empirical. The author here uses Tonks' equation of state (Abstr. 295/1937) for liquids and shows how a value of K in agreement with the empirical values can be obtained. T.C.Toye

532.77 : 541.135

3774. NEIGHBOR INTERACTIONS AND SYMMETRIC PROPERTIES OF POLYELECTROLYTES.
S.Lifson, B.Kaufman and H.Lifson.
J. chem. Phys., Vol. 27, No. 6, 1356-62 (Dec., 1957).

The grand partition function of polyelectrolyte molecules, considered as linear Ising chains, is studied with respect to certain symmetry properties of these systems. The degree of ionization and the buffering capacity are shown to possess a symmetry with respect to the point of half neutralization. Equations for the pH, the degree of ionization, and the buffering capacity are derived explicitly for a model in which only the interactions between first- and second-neighbours are taken into account. The results are compared with those of the theory of first-neighbour interactions, and graphs of titration and buffering-capacity curves are given. The properties of the maxima and minima occurring in the buffering-capacity curves are discussed. It is found that the form of buffering-capacity curve provides information on the order of non-negligible interactions.

A.

532.77

3775. THEORY OF DILUTE POLYMER SOLUTION. I. EXCLUDED VOLUME EFFECT. M.Kurata, H.Yamakawa and E.Teramoto.
J. chem. Phys., Vol. 28, No. 5, 785-91 (May, 1958).

A statistical theory of the excluded volume effect in a polymer molecule is developed, making use of a pearl necklace model with a continuous medium approximation. For the mean square end-to-end distance $\langle R^2 \rangle$ and the mean square radius of gyration $\langle S^2 \rangle$, the theory leads to the same expressions as Zimm, Stockmayer, and Fixman's. Taking solutions of polystyrene in cyclohexane as an example, it is illustrated that, in the vicinity of the Flory temperature, the expression for $\langle S^2 \rangle$ enables a complete quantitative interpretation to be given to light scattering data. The distribution function for distance R_{kl} between segments k and l, its 2 mth moment $\langle R_{kl}^{2m} \rangle$, and the mean square distance $\langle S_k^2 \rangle$ between segment k and the centre of molecular mass are also calculated to make clear the nature of the excluded volume effect. Finally, the influence of the volume effect upon light scattering measurement is discussed somewhat in detail.

A.

532.78 : 539.219

STRUCTURAL PECULIARITIES OF LIQUID ALLOYS.
See Abstr. 3485

MECHANICS OF GASES

533.15 : 551.513.1

3776. THE THEORY OF MOLECULAR DIFFUSION IN THE ATMOSPHERE. P.Mange.
J. geophys. Res., Vol. 62, No. 2, 279-96 (June, 1957).

The mathematical theory of minor-constituent, neutral-particle

iffusion is reviewed and extended to take account of diffusion in an tmosphere with linearly varying scale height. In addition, solutions re formulated for minor constituent diffusion in the presence of inks and sources (simultaneous production). Various simplified riteria of diffusion which were used formerly are reviewed, and a eneral criterion is proposed. Application of the general theory to hree particular problems is briefly indicated. In the first, it is hown that under the simultaneous action of diffusion and mixing the nolecular oxygen distribution above 100 km altitude must depart rom a photochemical equilibrium distribution. Secondly, the down- ard migration of calcium continuously introduced into the atmos- here by meteors is described. Finally, the usefulness of the theory s shown in analysing the downward migration of nitrogen atoms rom a high-level production region. A.

533.16 : 536.23 : 523.877

VISCOSITY COEFFICIENT IN THE HYDROGEN CONVECTION ZONE. See Abstr. 3660

533.275 : 551.508.71

3777. ELECTRIC HYGROMETERS. A.Wexler.
Circ. Nat. Bur. Stand., No. 586, 21 pp. (Sept. 3, 1957).

A review is presented of the art of measuring the moisture con- ent of air by the methods of electric hygrometry. The basis of these nethods is the change in electrical resistance of a hygroscopic naterial with change in humidity. A.

533.5 : 531.788.7

3778. OPERATION OF AN INVERTED-MAGNETRON GAUGE IN THE PRESSURE RANGE 10^{-3} TO 10^{-12} mm Hg.
J.P.Hobson and P.A.Redhead.
Canad. J. Phys., Vol. 36, No. 3, 271-88 (March, 1958).

A cold-cathode ionization gauge with axial magnetic field and adial electric field is described, which is useful in the pressure ange from 10^{-3} to 10^{-12} mm Hg and has a sensitivity of about A/mm Hg. This gauge has the structure of an inverted magnetron ith an auxiliary cathode which provides the initial field emission nd allows the positive-ion current to be measured independently of he field-emission current. The operation and calibration of the auge in a dynamic vacuum system is described for the pressure ange from 10^{-3} to 5×10^{-9} mm Hg. Pressure ranging from 10^{-8} o 10^{-12} mm Hg were obtained in sealed-off systems. Liquid- elium trapping was used for pressures below 10^{-10} mm Hg. It is hown that the gauge gives a reliable indication of pressure below 0^{-10} mm Hg when the pressure is determined by helium diffusion rough the envelope. A.

533.5 : 545.844

3779. LEAK TESTING OF VACUUM PLANT BY HELIUM NALYSIS. E.Glueckauf and G.P.Kitt.
. sci. Instrum., Vol. 35, No. 6, 220-3 (June, 1958).

An apparatus is described for determining the extent and location f leakages in the operation of gas plants, working at reduced pres- ures, by the analysis of the rare gases, helium and neon, contained aturally in the in-leaking air. It can generally be applied when ydrogen, helium and neon are normally absent from the plant gases. n accuracy of 0.5% for the analysis of a sample of gas containing .5 ml. of leakage air can be obtained, but it appears that the detec- on of 0.01 ml. of air is the lower limit using a commercial ioniza- on gauge as the sensitive element. A.

533.5 : 531.788.1

3780. NEW ACOUSTICAL METHOD OF VACUUM MEASUREMENT. J.Antal and A.König.
Periodica polytech., Elect. Engng, Vol. 1, No. 3, 297-300 (1957).

An approximate theory and brief description are given of a ethod of measuring pressures between 1 atm and 5×10^{-2} mm Hg. sing sound energy of frequency between 500 and 10 000 c/s radiated rom a loudspeaker and collected by a microphone provided with a oltmeter. The lowest measurable pressure was limited by the ound energy conducted through the walls of the enclosure.

J.M.Zarzycki

533.5 : 531.788.7

3781. INFLUENCE OF OSCILLATIONS ON THE PRODUCTION OF IONS IN AN IONIZATION GAUGE. J.Habanec.
Laboproudý Obzor, Vol. 19, No. 3, 140-3 (1958). In Czech.

The ionization gauge considered is an indirectly-heated triode aving either flat or cylindrical electrodes. The grid of the triode at a positive potential, while the anode and the cathode are at a egative (or zero) potential. The gauge is fitted with a special lectrode having a negative potential (with respect to the cathode), hich is used to measure the ion current in the valve. Operation of the valve is analysed, and it is shown that, if an external v.h.f. field is applied between the grid and the anode (or the grid and the cathode), the ionization in the gauge can be substantially increased. In practice it was found that, provided the ratio between the electron transit time and the external frequency was properly chosen, the ion current could be increased fourfold. R.S.Sidorowicz

533.5 : 531.788.7 : 537.534.3

GETTERING OF OXYGEN BY A NONOPERATING ION GAUGE. See Abstr. 3190

533.58

3782. ELECTRONIC ULTRA-HIGH VACUUM PUMP. L.D.Hall.
Rev. sci. Instrum., Vol. 29, No. 5, 367-70 (May, 1958).

A pump was developed based on the combined effects of ioniz- ation, excitation and sputtering. A cold-cathode discharge in mag- netic field is employed, with no hot filaments nor moving parts. The ultimate vacuum attainable is not yet known but is probably below 2×10^{-10} mm Hg. A pumping speed of about 10 litre/sec for air was recorded at 1×10^{-7} mm Hg. The pump replaces liquid nitrogen-trapped oil diffusion pumps for pumping microwave tubes. A.

533.6.011.31

3783. EXPERIMENTAL STUDIES ON THE STABILITY OF THE TRANSONIC FLOW PAST AIRFOILS. F.Tamaki.
J. Phys. Soc. Japan, Vol. 12, No. 5, 544-9 (May, 1957).

Local flow fluctuations near an aerofoil surface was measured in the speed range near critical Mach number, by using a Mach–Zehnder interferometer and a rotating-drum camera. Aerofoils tested were the Tomotika-Tamada aerofoil, the NACA-0012 and a 10% thick elliptic cylinder. Experiments show that the amplitude and frequency of the oscillation that appears when the local sonic speed is exceeded on the surface depend on the shape of the profile. For T.T. and 0012 aerofoils, the oscillation is of small amplitude and high frequency when the maximum local Mach number on the surface is not much above unity, and the time-mean pressure distri- bution on the surface is smooth and shows no appreciable distortion due to shock waves. In the case of the elliptic cylinder, slow oscil- lation of large amplitude, involving distinct shock waves, appears as soon as sonic speed is exceeded on the surface. A.

533.6.011.5

3784. ON THE HYPERSONIC VISCOUS FLOW PAST A FLAT PLATE WITH SUCTION OR INJECTION. M.Yasuhara.
J. Phys. Soc. Japan, Vol. 12, No. 2, 177-82 (Feb., 1957).

The supersonic viscous flow past a flat plate with suction or injection is dealt with by Kármán–Pohlhausen's method for the special cases where the suction or injection velocity is proportional to $p^{1/2}$ or $x^{-1/4}$ (especially for the region of strong interaction between the shock wave and the boundary layer), where p_B is the pressure on the plate and x the distance along the plate from its leading edge. A.

533.6.011.5

3785. STUDIES ON THE HYPERSONIC FLOW USING A DOUBLE-DIAPHRAGM SHOCK TUBE. F.Tamaki and Kim Chul-Soo.
J. Phys. Soc. Japan, Vol. 12, No. 5, 550-5 (May, 1957).

A shock tube having two partition diaphragms was devised for generating a supersonic flow free from air liquefaction. The tube consisted of high and medium pressure chambers of equal cross- section and a low pressure chamber with a narrow, slit-shaped inlet and a large area divergence. Supersonic flow was generated by the expansion into the low pressure chamber of the air, which was initially contained in the medium pressure chamber, and compressed to high pressure and temperature by the nearly closed-wall reflection of the shock wave created by the rupture of the diaphragm between high and medium pressure chambers. Flow of Mach number 6.4 and of 1 msec duration was obtained and used for the study of flow past elliptic-nosed plates. Axis-ratios tested were 8, 1 (semi- circular nose) and 0 (square nose). Pressure distribution over the surface and head drag coefficient were determined by using a Mach–Zehnder interferometer. A.

533.6.05

3786. INVESTIGATION OF THE FLUCTUATING PRESSURES ON A CIRCULAR CYLINDER IN AN AIRSTREAM.
D.M.McGregor and B.Etkin.
Phys. of Fluids, Vol. 1, No. 2, 162-4 (March-April, 1958).

An investigation was made of the fluctuating pressure acting on a circular cylinder in a fluid stream at velocities below that of sound — results are quoted for speeds of 75 and 211 ft/sec. A con- denser microphone mounted internally was used to measure the pressures and for various points on the cylinder a pressure coeffic-

ient was determined, being the ratio of the r.m.s. value of the fluctuating pressure to the dynamic pressure. The spectrum relating the pressure coefficient to frequency was analysed by passing the signals through a third-octave filter, and at a speed of 75 ft/sec a fundamental frequency occurred at 200 c/s and a second harmonic at 400 c/s. The peak values of the coefficients at these two frequencies were plotted against the angle between stream direction and radius through the measuring point. The line for the fundamental agreed fairly well with theory, but the second harmonic did not. The amplitudes of the periodic lift and drag were derived from these curves and did not agree with those obtained by other investigators. A.C.Whiffin

MOLECULAR THEORY OF GASES

533.7

3787. VIRIAL EXPANSION THEORY FOR IMPERFECT GASES. D.N.Zubarev.
Dokl. Akad. Nauk SSSR, Vol. 118, No. 5, 903-6 (1958). In Russian.

The virial expansion is carried to an arbitrary number of terms; the effect of successive virial coefficients on the thermodynamic functions is investigated. J.W.Gardner

533.7

3788. ON THE VIRIAL COEFFICIENTS FOR A LENNARD-JONES GAS. L.H.Nosanow and J.E.Mayer.
J. chem. Phys., Vol. 28, No. 5, 874-7 (May, 1958).

Simpler methods for computing the second and third virial coefficients for a Lennard-Jones gas are given. The second virial coefficient is found to obey a second-order linear homogeneous differential equation in the temperature. The use of these methods is discussed. A.

533.7

3789. A SIGNIFICANT ERROR IN THE DETERMINATION AT LOW PRESSURES OF THE VIRIAL COEFFICIENTS OF VAPOURS. R.Whytlaw-Gray and G.A.Bottomley.
Nature (London), Vol. 180, 1252 (Dec. 7, 1957).

The differential method of measuring virial coefficients (Abstr. 9486/1955) shows systematic errors near saturation which were shown to be due to absorption of the gas on Pyrex glass and on mercury. The latter can be eliminated and former allowed for by using published absorption data. The correction to the second virial coefficient of benzene at 22°C is about 2%. R.O.Davies

533.7

3790. ON THE TRANSPORT EQUATION FOR DILUTE GASES. I.Prigogine and F.Henin.
Physica, Vol. 24, No. 3, 214-30 (March, 1958).

The equation is developed by an expansion in powers of the time, for systems of any degree of coupling. A diagrammatic representation of contributions to the interaction matrices, which appear as diagonal singularities related to the number of degrees of freedom, is described. The diagram is simplest for low concentrations, when the main contribution arises from two successive interactions of all possible pairs of particles in which the original wave numbers are restored. P.Gray

VIBRATIONS. ACOUSTICS

534

3791. SOVIET ACOUSTICS OVER THE LAST 40 YEARS.
Akust. Zh., Vol. 3, No. 4, 299-321 (1957). In Russian.

An historical account is given covering: architectural acoustics; electro-acoustics; musical acoustics; ultrasonics; propagation of sound and the acoustics of non-homogeneous and moving media; physiological acoustics and noise. C.R.S.Manders

534.01 : 371.3

3792. ON THE TEACHING OF "STANDING WAVES". J.Rekveld.
Amer. J. Phys., Vol. 26, No. 3, 159-63 (March, 1958).

A theoretical discussion of the fundamental differential equation for standing-wave motions leads to an approach in which these motions are considered as natural modes of vibrations (eigenvibrations). An outline for a teaching method emphasizing this aspect is given. A.

534.01

3793. ON THE DISPERSION OF LINEAR KINEMATIC WAVES. R.Aris.
Proc. Roy. Soc. A, Vol. 245, No. 1241, 268-77 (1958).

In 1955 Lighthill and Whitham (Proc. Roy. Soc. A, Vol. 229, 281, 318, 1955) drew attention to a class of wave motion which arises from the equation of continuity of a flow q and a concentration k and a functional relation between q and k. In contrast to the motions governed by the classical wave equation these are called kinematic waves (the movement of floods and of traffic are examples). The theory of kinematic waves is taken up here for the case when the concentration k and flow q are related by a series of linear equations. If the initial disturbance is hump-like it is shown that the resulting kinematic wave can be usefully described by the growth of its mean and variance, the former moving with the kinematic wave velocity and the latter increasing proportionally to the distance travelled. Conditions for these moments to be calculated from the Laplace transform of the solution, without the need of inversion, are obtained and it is shown that for a large class of waves, the ultimate wave form is Gaussian. The power of the method is shown in the analysis of a kinematic temperature wave, where the Laplace transform of the solution cannot be inverted. A.

534.121.1

3794. VIBRATIONS OF A MONOCLINIC CRYSTAL PLATE. E.G.Newman and R.D.Mindlin.
J. Acoust. Soc. Amer., Vol. 29, No. 11, 1206-18 (Nov., 1957).

A detailed study is made of Ekstein's solution of the equations of elasticity for the case of the coupled vibrational modes of an infinite, monoclinic, crystal plate with traction-free faces. It is shown how the spectrum of frequencies and the character of the modes may be deduced by tracing the development of coupling from a simple solution, in which the modes are uncoupled, and by taking into account the asymptotic behaviour at long and short wavelengths and high and low frequencies. The results of computations are given for the AT cut of quartz. The purpose of the investigation is to obtain some of the qualitative and quantitative information that is needed for the formulation of approximate equations of motion, which may be solved for plates of finite dimensions. A.

534.131 : 539.374

3795. THE BEHAVIOUR OF A VIBRATING VISCO-ELASTIC CYLINDER. N.B.Terry.
Proc. Phys. Soc., Vol. 71, Pt 6, 973-8 (June, 1958).

The general differential equation of wave motion for a Burgers body is used to express the attenuation and retardation time of a viscoelastic material in terms of the mechanical quality factor of a cylinder of the material set into forced vibration. It is assumed that the vibrations are induced by the action of a sinusoidal stress at one end of the cylinder. A.

534.133

3796. AMPLITUDE OF A QUARTZ PLATE VIBRATING IN LIQUIDS. S.Parthasarathy and H.Singh.
Nature (London), Vol. 181, 260 (Jan. 25, 1958).

The amplitude of the plane sound wave at the source of an ultrasonic beam is obtained by calorimetric measurements of the mean power of the sound. Data are presented for several organic liquids and compared with those derived from the theoretical relation given by Vigoureux. The experimental values are 10 to 25% lower than the corresponding theoretical values, the differences depending on the nature of the liquid. H.J.H.Starks

534.2

3797. THE PROPAGATION OF PULSES IN AN ELASTIC MEDIUM WITH ABSORPTION. N.F.Gorshkov.
Akust. Zh., Vol. 3, No. 2, 154-62 (1957). In Russian.

The propagation is considered of two types of wave — unit function and square wave — through an elastic medium, the absorption of which is proportional to the frequency or to its square. Estimates are made of the distortion the pulses undergo on account of the absorption. A proposal is made for determining the absorption coefficient from the change in slope of the forward edge of a pulse, and experiments in air are quote in support. C.R.S.Manders

534.2

3798. FLEXURAL WAVE DAMPING BY SYMMETRIC AND ECCENTRIC LOADING. H.L.Müller.
Frequenz, Vol. 11, No. 10, 325-30 (Oct.); No. 11, 342-51 (Nov., 1957). In German.

The second of these two papers is a continuation of the first

Reference is made to theoretical papers by Cremer (Marine-Forschungsbericht, No. 28, 1944, Arch. elekt. Übertragung, Vol. 7, No. 6, 1953) on the effect of mass-loading rods and plates by single and periodically placed masses (flexible "chain" guide). The author deals theoretically with the cases in which the load is attached symmetrically i.e. equally on opposite sides of the vibrating rod or strip, and eccentrically i.e. on one side only. Comparative curves are shown illustrating the relative damping effects of a single mass and of a number of separated masses, e.g. the damping due to a single six-unit mass compared with that due to a "chain" guide of six masses. An example of eccentric or one-sided loading is given as that of the ribbed decks and hull-plating of ships. As a consequence of the eccentric position of the centre of gravity of the attached mass-loading, there is a tendency for the flexural waves to be damped out. A.B.Wood

534.2 : 538.2 : 550.34

3799. THE INTERACTION BETWEEN ELASTIC WAVE MOTIONS AND A MAGNETIC FIELD IN ELECTRICAL CONDUCTORS. L.Knopoff.
J. geophys. Res., Vol. 60, No. 4, 441-56 (Dec., 1955).

The propagation of elastic waves in an electrically conducting solid permeated by a uniform, static magnetic field is discussed. In the case of plane wave motions, two systems of waves arise: a simple uncoupled system and a trimodal coupled system. In the uncoupled case, in which polarizations are unaltered, two dispersive, complex phase-velocities exist. For a weak impressed magnetic field, one of these velocities is close to the elastic wave velocity of the polarized wave in the absence of the field. The other wave, called an eddy current wave, although strongly attenuated, cannot be neglected in the solution of boundary value problems. When the theory of magnetoelastic interactions is applied to seismic motions in the conducting core of the earth, it is found that compressional waves are virtually unattenuated in the core for the pertinent values of frequency, conductivity, and magnetic intensity. It is concluded that magnetoelastic interactions are not a significant mechanism in the earth's core. A.

534.21

3800. SOME SECOND-ORDER QUANTITIES IN ACOUSTICS. L.A.Gol'dberg.
Akust. Zh., Vol. 3, No. 2, 149-53 (1957). In Russian.

From the equations derived in an earlier paper (Abstr. 3076/1957) the author obtains the hydrodynamic velocity, pressure and density in the second-order approximations for a plane sound-wave propagated in a viscous thermoconducting medium. C.R.S.Manders

534.21 : 536.42

3801. THE PROPAGATION OF SOUND AT THE CRITICAL POINT. Z.Fisher.
Akust. Zh., Vol. 3, No. 2, 208 (1957). In Russian.

Sundry observations are presented concerning the study of the velocity and absorption of ultrasonic waves in the region of the critical point. The full analysis of a given problem requires a knowledge of the precise behaviour of the thermodynamic functions in the critical region. At present this behaviour is not clear. It is suggested that the peculiarities encountered when investigating this region may be no greater than those of the relevant thermodynamics. C.R.S.Manders

534.21

3802. THE PROPAGATION OF PLANE WAVES OF FINITE AMPLITUDE. Z.A.Gol'dberg.
Akust. Zh., Vol. 3, No. 4, 322-8 (1957). In Russian.

The propagation of the waves in a viscous, heat-conducting medium is considered. Also studied is the criterion indicating when an explosion can be taken as a plane wave, and an estimate is made of the distance from the source to the onset of plane wave conditions. An expression is derived for the absorption coefficient for the case where an explosion is impossible, and for the case where it is possible. C.R.S.Manders

534.213

3803. FLUCTUATIONS OF AMPLITUDE AND PHASE IN A SPHERICAL WAVE. V.N.Karavainikov.
Akust. Zh., Vol. 3, No. 2, 165-76 (1957). In Russian.

The correlation coefficient is established between fluctuations of amplitude and phase occurring in a spherical wave. Also obtained are the coefficients of longitudinal and transverse self-correlation of amplitudes and phases. C.R.S.Manders

534.22 : 532.7

3804. [CONTRIBUTION TO THE] MOLECULAR THEORY OF THE VELOCITY OF SOUND IN LIQUIDS. I.Z.Fisher.
Akust. Zh., Vol. 3, No. 2, 206-7 (1957). In Russian.

There have been many attempts to give an expression for the velocity of sound in a liquid in terms of molecular characteristics. The present authors take a unidimensional model of a liquid and solve the problem accurately and completely. Analogous expressions have been found by others (e.g. Kudryavtsev, Uspekhi Khimii, Vol. 17, No. 2, 158-73/1948) for the three dimensional case, however, the expressions apply not to liquids but to crystals at absolute zero. C.R.S.Manders

534.22 : 532.7 : 541.135

3805. THE THEORY OF RELAXATION ABSORPTION AND DISPERSION OF SOUND IN STRONG, BUT NOT FULLY DISSOCIATED ELECTROLYTES. V.P.Glotov.
Akust. Zh., Vol. 3, No. 3, 220-9 (1957). In Russian.

Relaxation theory is used for the calculation of the abnormally large absorption (and dispersion) of sound that is observed in aqueous solutions of certain salts in the range of frequencies up to 1 Mc/s. A mechanism is examined of the relaxation of the dissociation of the electrolyte, making use in the calculation of the thermodynamic potential of a real solution. Using the formulae obtained, a numerical estimate is made of the absorption coefficient, the dispersion and the relaxation time of an aqueous solution of $MgSO_4$. C.R.S.Manders

534.22

3806. ON THE PROPAGATION OF SOUND IN SEAWATER [AND DISTILLED WATER]. A.V.J.Martin.
Ann. Geophys., Vol. 13, No. 4, 307-9 (1957). In French.

The velocity of h.f. sound waves in distilled water and in standard seawater (35% salinity) was determined at 25°C and between 0 and 1000 atm using a pulse technique. Good agreement with previous work is claimed. H.D.Parbrook

534.22 : 534.321.9 : 539.32

3807. ULTRASONIC INTERFEROMETER FOR THE MEASUREMENT OF THE TEMPERATURE DEPENDENCE OF ELASTIC CONSTANTS. R.P.Espinola and P.C.Waterman.
J. appl. Phys., Vol. 29, No. 4, 718-21 (April, 1958).

An ultrasonic interferometer method is described for relatively precise measurement of changes in velocities in solids; fractional velocity changes as small as 5×10^{-6} can be detected by this method. Application of the interferometer to specimens in which the temperature is varied yields the temperature dependence of the appropriate adiabatic elastic stiffness constants. Some results are reported for steel, fused silica, and single crystals of KBr, KCl and LiF. A.

534.221 : 536.633

3808. MEASUREMENTS ON THE VELOCITY OF SOUND IN OXYGEN GAS UNDER HIGH PRESSURE. A.van Itterbeek and J.Zink.
Appl. sci. Res. A, Vol. 7, No. 5, 375-85 (1958).

Using the acoustical interferometer for high pressures described in an earlier publication (see Abstr. 6964/1957), the velocity of sound in oxygen gas between 1 and 70 atm was measured as a function of pressure at different temperatures. From the experimental data the change of the ratio of the specific heats and the specific heats themselves, as a function of pressure at the different temperatures, were calculated. A.

534.222 : 551.51

3809. THE FOCUSING OF ENERGY CAUSED BY IRREGULAR SOUND PROPAGATION. Y.Rocard.
C.R. Acad. Sci. (Paris), Vol. 246, No. 14, 2111-13 (April 9, 1958). In French.

Atmospheric temperature and wind speed variations can perturb the wave fronts from a sound source. A formula is developed for this effect and applied to the atmospheric conditions cause by thermonuclear explosions H.D.Parbrook

534.23

3810. ULTRASONIC INTERFERENCE FILTERS WITH VARIABLE FREQUENCY BAND-PASS. B.D.Tartakovskii.
Akust. Zh., Vol. 3, No. 2, 183-91 (1957). In Russian.

A theoretical investigation is made of the properties to be expected in variable-frequency-pass, ultrasonic interference-filters consisting of layers of material. The output is calculated for frequency and direction in terms of the parameters of the layers

and inter-layers. Results are given of an experimental investigation of the performance of a three-layer filter of thin aluminium plates in water with variable spacing. C.R.S.Manders

534.23

3811. THE ACOUSTIC PARAMETERS OF SOME SOUND-ABSORBING MATERIALS. Z.N.Baranova and K.A.Velizhanina.
Akust. Zh., Vol. 3, No. 2, 99-103 (1957). In Russian.

A table is given of the l.f. acoustic parameters of layers of various, simple, sound-absorbing materials, e.g. glass wool, cotton wool, and glass fibre sized with starch. C.R.S.Manders

534.23

3812. THE PROBLEM OF TEMPERATURE DEPENDENCE OF THE ABSORPTION OF WAVES OF FINITE AMPLITUDE IN VISCOUS LIQUIDS. L.K.Zarembo.
Akust. Zh., Vol. 3, No. 2, 163-4 (1957). In Russian.

Measurements were made of the absorption coefficient of transformer oil for 1.5 Mc/s waves over a temperature range from 18.5° to 67.3°C. Although the shear viscosity of the liquid falls by 80% for this rise in temperature, the absorption was found to increase. It is suggested that with a change of viscosity there occur changes in the processes of wave distortion. C.R.S.Manders

534.23 : 532.7

3813. THE ABSORPTION OF ULTRASONIC WAVES IN VISCOUS LIQUIDS. I.G.Mikhailov.
Akust. Zh., Vol. 3, No. 2, 177-82 (1957). In Russian.

Ultrasonic absorption was measured in castor oil and other liquids over a range from 0.26 to 30 Mc/s. For castor oil it was established that a square law variation of absorption with frequency is not maintained. It is suggested that these results are due to wide regions of relaxation, both for bulk and shear viscosity, which may be close to one another and overlap. C.R.S.Manders

534.23

3814. THEORY OF THE ULTRASONIC ABSORPTION IN AQUEOUS SOLUTIONS. II. AQUEOUS SOLUTIONS OF SOME ALCOHOLS. O.Nomoto.
J. Phys. Soc. Japan, Vol. 12, No. 3, 300-7 (March, 1957).

For Pt I see Abstr. 8630/1956. The anomalous parts of the ultrasonic absorption coefficient were calculated for aqueous solutions of methanol, ethanol and n-propanol, as functions of the concentration, by employing the result of the general theory described in Pt I. Calculations were made for two simplified model cases: (a) ignoring the difference in sizes of the single water molecule and the solute molecule; and (b) taking into account the difference in sizes of these molecules by approximating them by linear polymers each consisting of one kind of atom. The value of the absorption peaks and the location of them were found to be in semi-quantitative agreement with experimental results, the agreement being somewhat better in case (b) than in (a). A.

534.23

3815. TEMPERATURE COEFFICIENT OF ULTRASONIC ABSORPTION IN ORGANIC LIQUIDS.
S.Parthasarathy, M.Pancholy and A.F.Chhapgar.
Nature (London), Vol. 181, 405-6 (Feb. 8, 1958).

This was measured in non-associated polyatomic liquids at 21 Mc/s and in the range from 15° to 60°C. The expected positive temperature coefficient is not always found. H.D.Parbrook

534.23

3816. PROPAGATION OF ULTRASONIC WAVES IN LIQUIDS.
A.K.Dutta and K.Samal.
Nature (London), Vol. 181, 563 (Feb. 22, 1958).

Experimental evidence is given suggesting that excessive absorption in CS_2 and C_6H_6 (and possibly in other liquids) is due to a mechanism producing a "confusion in phase relation during propagation". H.D.Parbrook

534.23

3817. AN EVALUATION OF THE SOUND ABSORPTION COEFFICIENTS MEASURED BY THE STANDING-WAVE METHOD AND BY THE REVERBERATION METHOD. J.B.Slavík and J.Tichý.
Slaboproudý Obzor, Vol. 18, No. 8, 545-8 (1957). In Czech.

Previously reported experimental results (Abstr. 5734/1956, 3117, 4104/1957) are quoted and compared, together with some supplementary data. It is found that there are considerable discrepancies between the values obtained by the two methods. It is therefore thought necessary to employ both types of measurement, until the value of the reverberation method is definitely established. R.S.Sidorowicz

534.23 : 534.26

3818. ABSORPTION AND DIFFUSE SCATTERING OF ULTRASOUND IN METALS. L.G.Merkulov.
Zh. tekh. Fiz., Vol. 27, No. 5, 1045-50 (1957). In Russian.

Measurements were made by an impulse technique on polycrystalline material in the frequency range from 5 to 180 Mc/s. Provided that the wavelength is greater than the mean dimension of the grains D, the absorption coefficient γ, as a function of frequency f, may be written approximately as: $\gamma = R.D + A_1 f + A_2 f^2$. The first term represents the loss due to reflection from grain boundaries, and R may be calculated approximately in terms of the elastic constants, assuming small elastic anisotropy and random grain-orientations. The second and third terms are connected with hysteresis and thermo-elastic losses, respectively, A_1 and A_2 being constants. By graphical treatment of the observed variations of γ with f, it was shown that the magnitude of the first term was in rough agreement with the theoretically predicted value for two Al ingots (99.5% Al), two ingots of a Mg–Mn alloy (Mg 98.5, Mn 1.5%), and an Fe ingot of technical purity (C < 0.02%). The grain-sizes used ranged from 0.25 to 2 mm. It is suggested that measurements of ultrasonic absorption might be useful in determining grain-sizes and textures. Metallurgical Abstracts

534.231

3819. THE CORRELATION OF [ACOUSTIC] FIELD FLUCTUATIONS. L.A.Chernov.
Akust. Zh., Vol. 3, No. 2, 192-4 (1957). In Russian.

Formulae are obtained establishing a connection between the correlation function for field fluctuations and the self-correlation functions for fluctuations of level and phase. C.R.S.Manders

534.232

3820. AN OPTICAL METHOD OF ABSOLUTE CALIBRATION OF ACOUSTIC RADIATORS AT LOW SONIC FREQUENCY.
G.P.Motulevich and I.L.Fabelinskii.
Akust. Zh., Vol. 3, No. 2, 205-6 (1957). In Russian.

In an earlier paper (Abstr. 340/1957) the authors showed how the refractive index varies with density at low acoustic frequency. A tube, the ends of which were closed by optical glass blocks, was filled with a liquid of known refractive index, density and frequency characteristics and the radiator connected to it. The tube dimensions were small compared with the wavelength. The unit was then included in one arm of an optical interferometer, e.g. of the Jamin type. By altering the current or voltage to the radiator in a smooth manner the interference pattern was made to appear and disappear. From the optical-path-length changes so caused, and with knowledge of the behaviour of the liquid, the acoustic field intensities were calculated, and hence an absolute calibration of the radiator was carried out. C.R.S.Manders

534.232

3821. COMPUTATION OF ULTRASONIC CONCENTRATORS [HORNS]. L.G.Merkulov.
Akust. Zh., Vol. 3, No. 3, 230-8 (1957). In Russian.

The horns considered are of conical, exponential and catenoidal form. Equations are derived for the calculation of their resonance dimensions and amplification coefficients. The internal volume of the horn is treated as a longitudinally vibrating rod of variable cross-section, and the wave-front is assumed to remain plane during its passage through the horn. Intensity is also assumed to be uniform over the wave-front. For a trumpet long compared with its diameter these assumptions are shown to be valid enough. A catenoidal tube gives the greatest amplification. Experimental tests show good agreement with theory. C.R.S.Manders

534.232

3822. MINIATURE PIEZOELECTRIC ULTRASONIC RECEIVERS.
E.V.Romanenko.
Akust. Zh., Vol. 3, No. 4, 342-7 (1957). In Russian.

A description is given of the construction, use and method of calibration. The $BaTiO_3$ element (diameter about 0.2 mm) has a sensitivity of 0.004 to 0.007 μV/b. C.R.S.Manders

534.232

3823. REPRESENTATION OF THE FIELD OF AN ACOUSTIC SOURCE AS A SERIES OF MULTIPOLE FIELDS. H.L.Oestreicher
J. Acoust. Soc. Amer., Vol. 29, No. 11, 1219-22 (Nov., 1957).

A representation of the field of a sound source of arbitrary shape and size as a series of multipole fields of increasing order is derived. This series is convergent for sources of any size if the surface is sufficiently regular, but its main advantage is for sources small compared to the wavelength. In this case the source has, in general

the directivity pattern of a multipole, the order and strength of which can be determined from the formula. Although the representation is not unique, certain coefficients have physical significance. The presently used definition of "strength of a sound source" is discussed and a modified definition suggested. A.

534.232 : 534.24

3824. OUTPUT OF A SOUND SOURCE IN A REVERBERATION CHAMBER AND OTHER REFLECTING ENVIRONMENTS. R.V.Waterhouse.
J. Acoust. Soc. Amer., Vol. 30, No. 1, 4-13 (Jan., 1958).

It is important to know the output of a source as a function of position in a reverberation chamber. Expressions are given for the sound power output of simple monopole and dipole sources as functions of source position in various reflecting environments. They are obtained by the use of the method of images and a general formula due to Rayleigh for the output of a number of simple sources. The cases of a dipole source near a reflecting plane and a simple source near a reflecting edge and corner are treated, and the effect of the bandwidth of the source is considered. The results apply when the reflectors enclose the source, as in a reverberation chamber, unless the distance in wavelengths between parallel walls is small and the absorption in the enclosure is low. Some experimental data are given,and the reverberation chamber method of measuring the power output of sources is discussed. In the general case of an extended source emitting nonspherical waves near reflecting surfaces, it may be more convenient to find the variation of power output with position by experiment than by calculation. A.

534.24

3825. REFLECTION OF PLANE WAVES OF SOUND FROM A SINUSOIDAL SURFACE. H.S.Heaps.
J. appl. Phys., Vol. 28, No. 7, 815-18 (July, 1957).

When a plane wave of sound is incident upon a sinusoidal surface, part of the reflected radiation consists of undamped plane waves that travel away from the boundary. Under the assumption that no other reflected radiation is present the amplitudes of the plane waves are chosen to minimize the mean square value of the surface pressure. The amplitudes so obtained agree with the experimental results of LaCasce and Tamarkin (Abstr. 1926/1956). Except in the case of the specularly reflected wave the agreement is better than that obtained in previous analyses. A.

534.24

3826. REFLECTION ON A ROUGH SURFACE FROM AN ACOUSTIC POINT SOURCE. M.A.Biot.
J. Acoust. Soc.Amer., Vol. 29, No. 11, 1193-200 (Nov., 1957).

A simple solution is developed for the reflected waves on a rough surface from a simple harmonic point source. It is assumed that the roughness is represented by a distribution of hemispherical bosses whose size and mutual distance are small relative to the wavelength. It is shown that under these conditions the effect of the roughness is equivalent to a boundary condition for the wave equation. This boundary condition embodies the surface polarization and the mutual interaction of the bosses. If the generating source lies above the reflecting surface the reflected wave is found to be equivalent to that originating from concentrated and distributed image sources on a line situated below the specular image, with a magnitude decreasing exponentially with depth. The case of vanishingly small roughness is discussed, together with the field intensity at large distance and grazing incidence. The effect of fluid viscosity is also evaluated. A.

534.321.9 : 534.23

3827. BASIC CONCEPTS OF ULTRASONIC INTERFEROMETRY IN LIQUIDS. E.F.Carome, F.A.Gutowski and D.E.Schuele.
Amer. J. Phys., Vol. 25, No. 8, 556-64 (Nov., 1957).

The use of the acoustic interferometer to investigate the absorption of ultrasound in liquids is discussed. Following elementary treatments of the propagation of acoustic waves in liquids and the properties of the piezoelectric sound source, a simple method is developed for measuring the sound absorption coefficient. Emphasis is placed on the concepts of the acoustic impedance of the liquid and the effective electrical impedance of the sound source. A.

534.321.9 : 532.65

ULTRASONIC FOG PRODUCED IN MOLTEN METALS. See Abstr. 3766

534.39

3828. AXISYMMETRICAL ACOUSTIC STREAMING AT A RESONATOR. P.N.Kubanskii.
Akust. Zh., Vol. 3, No. 4, 337-41 (1957). In Russian.

The phenomenon is observed at the flanged aperture of a resonator excited by large amplitude oscillations. From the general theory of acoustic streaming, expressions are derived for streaming velocity and flow function. The results of calculation are compared with those of other workers in the field and with experimental data. C.R.S.Manders

534.39

3829. A METHOD OF VISUALIZATION OF ACOUSTIC STREAMING AT THE BOUNDARY OF TWO NON-MISCIBLE LIQUIDS. L.K.Zarembo and V.V.Shklovskaya-Kordi.
Akust. Zh., Vol. 3, No. 4, 373-4 (1957). In Russian.

A layer of vaseline oil was placed on top of a layer of glycerine. The source was a quartz plate radiating megacycle waves. A drop of coloured water placed at the boundary of the two liquids spreads in such a way as to show the distribution of the liquid velocities.

534.414

3830. INVESTIGATIONS ON NON-LINEAR HELMHOLTZ RESONATORS. F.Barthel.
Frequenz, Vol. 12, No. 3, 72-82 (March, 1958). In German.

The increase in the static and acoustic flow resistance for apertures between 2 and 15 mm diameter can be calculated by the Bernoulli equation, assuming the usual type of jet contraction. The results are valid only for aperture depths of 0.1 mm or less. It is shown how it is possible to construct resonators in which the degree of absorption between 90 and 100 dB can be raised from 50 to 75%, and how this can be demonstrated. The impedance of the aperture with a superposed steady flow, the overtones arising from the non-linear action of the aperture, and the breakdown of the superposition principle are discussed. H.J.H.Starks

534.64

3831. CHANGE IN ACOUSTIC IMPEDANCE DETECTED BY NUCLEAR INDUCTION. D.A.Jennings and W.H.Tanttila.
J. Acoust. Soc. Amer., Vol. 30, No. 2, 154 (Feb., 1958).

A nuclear induction method (Abstr. 4844/1955) was used to detect the successive acoustic resonances of a crystalline sodium chloride rod. H.D.Parbrook

534.7

PHYSIOLOGICAL ACOUSTICS. HEARING. See also under "Medical science. Human physiology". Decimal classification

534.781

3832. FURTHER TEST OF THE CONSTANT-RATIO RULE IN SPEECH COMMUNICATION. F.R.Clarke and C.D.Anderson.
J. Acoust. Soc. Amer., Vol. 29, No. 12, 1318-20 (Dec., 1957).

The use of the constant-ratio rule to predict the confusion matrices for each of two five-item subsets given the confusion matrix for a ten-item master set is tested with naive subjects. Ninety per cent of the predicted cell entries (expressed as proportions) deviated by less than 0.05 from the obtained cell entries. The predicted articulation score for the first subset was 67.9%, and the obtained articulation score was 68.9%. For the second subset the predicted and the obtained articulation scores were 78.4% and 82.6%, respectively. A.

534.781

3833. EFFECTS OF AMBIENT NOISE ON SPEAKER INTELLIGIBILITY FOR WORDS AND PHRASES.
J.J.Dreher and H.J.O'Neill.
J. Acoust. Soc. Amer., Vol. 29, No. 12, 1320-3 (Dec., 1957).

The Lombard, or voice reflex, effect results in speech with characteristics different from those of speech that is normally produced. This change of characteristics can be demonstrated as an effective way to combat noise interference during reception. It also demonstrates the advisability of control of the production of speech by the speaker himself, in addition to that offered by equipment, during audiological evaluations. Fifteen naive speakers read words and sentences while noise was being delivered to their headsets. There were five noise conditions. Their speech was recorded, with the noise being kept out of the recording channel, and then limited. Noise was then added to the recording in such a way as to produce a constant speech-to-noise ratio. The result was played to 200 listeners. Results indicate that,at a constant speech-to-noise ratio of reception,speech produced by a talker with masking noise in his ears becomes more intelligible as the masking level rises to a given value. The change in intelligibility throughout the range investigated suggest an application to audiological testing as well as a device for use in voice communication. A.

534.781 : 534.773

3834. SPEECH COMMUNICATIONS AT HIGH NOISE LEVELS: THE ROLES OF A NOISE-OPERATED AUTOMATIC GAIN CONTROL SYSTEM AND HEARING PROTECTION. I.Pollack.
J. Acoust. Soc. Amer., Vol. 29, No. 12, 1324-7 (Dec., 1957).

Two aids for hearing conservation, a noise-operated automatic gain control system and an insert ear protection, were evaluated in terms of their effect upon speech intelligibility. At high noise levels, these aids not only do not interfere with the speech intelligibility, they may substantially improve speech intelligibility while affording hearing protection. A.

534.781 : 534.61

3835. RELATIVE INTENSITIES OF SOUNDS AT VARIOUS ANATOMICAL LOCATIONS OF THE HEAD AND NECK DURING PHONATION OF THE VOWELS. H.M.Moser and H.J.Oyer.
J. Acoust. Soc. Amer., Vol. 30, No. 4, 275-7 (April, 1958).

Speech signals from 16 different anatomical locations were recorded as subjects intoned different vowels at a constant level. Power level analysis was made to determine relative intensity of the signals. It was found that significant difference in intensity exists among the anatomical locations. Some locations of lesser intensity were subjectively evaluated as providing more faithful signals.

A.

534.83 : 532.51

3836. FLOW NOISE.
Nature (London), Vol. 181, 388-9 (Feb. 8, 1958).

Report of a conference on aero- and hydrodynamic noise, organized by the Physical Society and the Institute of Physics, and held in Newcastle-upon-Tyne on 15-16 November 1957. Three papers were given on turbulence and its relation to noise, and seven essentially on discrete frequency sound phenomena.

H.D.Parbrook

534.842

3837. ACOUSTICAL CRITERIA OF OUTSTANDING OLD AND NEW CONCERT HALLS. F.Winckel.
Frequenz, Vol. 12, No. 2, 50-9 (Feb., 1958). In German.

The six best pre-war concert halls in the world are compared with 18 outstanding post-war halls, and as a general characteristic the latter are shown to have a lower reverberation time (0.2 to 0.5 sec at 500 c/s) than the former. Present day architectural styles do not readily meet the currently accepted requirements for good acoustics, although the significance of some of these is queried. The three most effective old concert halls still in use were built between 1869 and 1900, and their good musical acoustics are attributed to their neo-classical style. H.D.Parbrook

534.843

3838. GENERAL AND PARTICULAR CRITERIA OF THE ACOUSTIC QUALITY OF ROOMS. THEIR ADEQUACY. E.E.Golikov.
Akust. Zh., Vol. 3, No. 2, 142-8 (1957). In Russian.

In an earlier paper (Abstr. 3114/1957) the author put forward a new criteria, a modification of the Sukharevskii–Strutt coefficient, for evaluating the acoustics of rooms. In the current paper this coefficient and the optimum reverberation time are discussed as general and particular criteria of the articulation quality of rooms.

C.R.S.Manders

534.843

3839. TEST OF THE ROOM-ACOUSTIC "ECHO-GRADIENT CRITERION" BY MEANS OF SYLLABLE INTELLIGIBILITY MEASUREMENTS. H.Niese.
Hochfrequenztech. u. ElektAkust., Vol. 66, No. 3, 70-83 (Nov., 1957). In German.

Reference is made to earlier papers by Maxfield and Albersheim (J. Acoust. Soc. Amer., Vol. 19, 71, 1947), R.Thiele (Abstr. 2215/1954) and the present author (Abstr. 3115, 6967-8/1957) dealing with the questions of apparent "liveness" of rooms and intelligibility of speech in auditoria. The "echograd", defined as the ratio of disturbing sound to the total sound (useful plus disturbance), has been discussed in the author's earlier papers. In the present paper the echograd test, using measurements of intelligibility of syllables, is applied in the case of a number of large auditoria, churches and theatres in Germany. Numerous recordings in each auditorium are made in different locations and comparing right and left ears in estimating clearness or intelligibility of separate syllables. The measurements indicate a close correlation between subjective and objective measurements. A.B.Wood

OPTICS. RADIATION. SPECTRA

535.231.5 : 536.33

3840. BLACKBODY RADIATION AND THE RADIATION LAW CONSTANTS. F.Hoffmann and U.Schley.
S.B.Heidelberg. Akad. Wiss. (math. nat. Kl.), 1956-57, No. 4, 371-82. In German.

A discussion of (a) the International temperature scale (1948) in relation to the radiation-temperature and gas-thermometer scales; (b) the theoretical value of the second radiation constant c_2 compared with empirical values derived from optical pyrometer data. D.R.Barber

535.313 : 535.316/.317

3841. ON THE USE OF THE OPTICAL PATH CONCEPT IN THE STUDY OF SPHERICAL SURFACES. D.G.Douglas.
Amer. J. Phys., Vol. 26, No. 1, 14-16 (Jan., 1958).

As illustrations of the use of the method, spherical aberration and astigmatism of a spherical surface are discussed. A.

535.317 : 535.13 : 621.396.677.8

3842. THE ELECTROMAGNETIC THEORY OF THE SPHERICAL LUNEBERG LENS. C.T.Tai.
Appl. sci. Res. B, Vol. 7, No. 2, 113-30 (1958).

A solution was obtained for the spherical or the three-dimensional Luneberg lens. The Luneberg lens is characterized by a refractive index which varies according to the relation $n = (2 - r^2/a^2)^{1/2}$, where n is the refractive index, a is the radius of the outer rim of the spherical lens, and r is the radial distance measured from the centre of the lens). A general discussion of vector wave-functions is given, which can be used to represent the electromagnetic field in a radially stratified medium. It is then applied specifically to the Luneberg lens. A number of important formulae pertinent to the problem are presented. The solution to another class of stratified lenses is briefly discussed. A.

535.317.1

3843. AN OPTICAL METHOD OF OBTAINING THE FREQUENCY RESPONSE OF A LENS. K.Hacking.
Nature (London), Vol. 181, 1158-9 (April 19, 1958).

Previous methods of frequency response measurement have needed a Fourier transform to be carried out by a computational procedure. A method is described which gives the frequency response directly and without continuously moving parts. The lens under test images a slit on to a sine-wave test pattern, placed in front of a second slit. The total light passing through is a measure of the response for a frequency dependent upon the dimensions and the orientation of the sine-wave test pattern. Practical details are given. R.W.Fish

535.317.25

3844. VARIATION OF PHOTOGRAPHIC RESOLVING POWER WITH LATERAL CHROMATIC ABERRATION. J.M.O'Connell.
J. Opt. Soc. Amer., Vol. 47, No. 11, 1018-20 (Nov., 1957).

Using Super-XX film, the behaviour of resolving power was investigated when various amounts of lateral chromatic aberration were introduced into the image of an otherwise diffraction-limited lens. The results show that small amounts of lateral chromatic aberration have a strong, adverse effect upon resolving power indicating that this aberration demands careful correction in photographic lenses required to resolve fine detail. A

535.317.4

3845. AN OPTICAL POLARIZATION METHOD FOR THE VISUAL ESTIMATION OF THE GEOMETRICAL ABERRATIONS OF OBJECTIVES. K.Rosenhauer.
Z. InstrumKde, Vol. 65, No. 9, 159-66 (Sept., 1957). In German.

The spherical aberration of a lens is commonly measured by the Wettauer method, which determines the zonal focus by the cross-over point of two narrow beams isolated by a zone plate in front of the objective. Greater precision is claimed by a modification, which polarizes each beam, mutually perpendicularly, and observes the image of a slit through a split analyser. The focus can be accurately judged when the two halves of the slit image form an unbroken line. The results of some typical measurements are given, which show that an accuracy of 1 part in 5000 of the focal length can be obtained. R.W.Fish

535.317.6 : 518.5

3846. CALCULATION OF AN OPTICAL MERIT FUNCTION AND ITS DERIVATIVES WITH RESPECT TO THE SYSTEM PARAMETERS. D.P.Feder.
J. Opt. Soc. Amer., Vol. 47, No. 10, 913-25 (Oct., 1957).

In designing lenses with automatic computing machinery it is necessary to have certain quantitative measures of lens performance which may be called performance numbers. In a perfect system all the performance numbers are zero. For practical systems it is the object of the designer to reduce the performance numbers to satisfactorily small quantities. It is the principal purpose of this paper to define a characteristic function suitable for use as a performance number, and to derive equations for computing this function and its derivatives with respect to the parameters of the system. The characteristic function H is defined to be the optical path difference between a principal ray and an arbitrary ray, measured on a sphere of infinite radius centred at the intersection of the principal ray and the focal plane. In addition performance numbers are developed for the chromatic aberration, distortion, and boundary conditions. A merit function is defined which comprises the individual performance numbers. A.

535.32

3847. QUANTUM THEORY OF THE REFRACTIVE INDEX. L.A.Mead.
Phys. Rev., Vol. 110, No. 2, 359-69 (April 15, 1958).

A slightly refined perturbation theory is used to obtain a unitary transformation which approximately diagonalizes the total Hamiltonian for a system made up of a radiation field in interaction with gas molecules. The dependence of the energy of the total system on the number of photons present gives the usual formula for the refractive index of a gas. The transformation is also applied to the field operators and it is shown that, within the approximations made, the phenomenological Maxwell equations are obeyed in the new representation as equations between certain matrix elements of operators. The transformed representation is also used to derive the Frank–Tamm formula for Cherenkov radiation. A.

535.323 : 539.232

3848. DETERMINATION OF THE REFRACTIVE INDEX OF THIN FILMS OF FATTY ACIDS. E.Hofmeister and E.Meyer.
Z. Phys., Vol. 149, No. 3, 340-4 (1957). In German.

Step-form built-up molecular films of fatty acids were deposited by the Langmuir-Blodgett technique (Abstr. 3926/1937) and their ellipticity for reflected light measured. For chains longer than C_{17} the refractive index n of all films, even when one molecule thick, is the same as n for the bulk acid; for shorter chains n is greater than for the bulk. S.J.Gregg

535.324 : 534.321.9

3849. THE REFRACTION OF LIGHT BY PROGRESSIVE WAVES OF FINITE AMPLITUDE. M.A.Breazeale and E.A.Heidemann.
Naturwissenschaften, Vol. 45, No. 7, 157 (1958).

The distortion of an initially sinusoidal ultrasonic progressive wave in a liquid due to deviations from Hooke's law was demonstrated by sending a beam of light of width much less than the wavelength of the sound through the liquid parallel to the wavefronts. A difference between the intensities refracted away from and towards the sound source indicated the presence of higher harmonics in the waves. Three photoelectric methods used to detect this difference are briefly described. W.T.Welford

535.33.03

3850. THE EXCITATION OF SPECTRA BY A LOW-VOLTAGE PULSE DISCHARGE IN VACUO. F.Z.Pedos and N.S.Sventitskii.
Optika i Spektrosk., Vol. 4, No. 3, 407-9 (1958). In Russian.

A circuit for the discharge is described and the influence of a third electrode on the regulation of the arc discussed. Cu spectra are given to illustrate the point that the pulse discharge in vacuo gives a higher degree of excitation than a discharge in air and the latter in turn gives more spark-like spectra than the a.c. arc. L.Bovey

535.33.03 : 539.18

3851. COHERENT EMISSION LIGHT SOURCE. B.Griffiths and R.H.Dicke.
Rev. sci. Instrum., Vol. 28, No. 8, 646-8 (Aug., 1957).

A sharp, intense emission line may be obtained by use of resonance radiation coherently scattered from a collimated beam of atoms. The coherently scattered light may be separated from the exciting radiation by placing the atomic beam in one arm of a Mach-Zehnder interferometer, or by diffraction from several parallel atomic beam pencils. The latter technique was tested experimentally by observing hyperfine structure in light coherently scattered from a beam of Na atoms. A.

535.33.03 : 522.615

A DIRECT-RECORDING PHOTOELECTRIC SPECTROPHOTOMETER. See Abstr. 3633

535.33.07

3852. AN ULTRA-MICRO FLAME SPECTROPHOTOMETER. D.Exley and D.Sproat.
J. sci. Instrum., Vol. 35, No. 6, 202-6 (June, 1958).

A description is given of a modified Beckman DU flame spectrophotometer fitted with an integrating circuit. An electronic switching arrangement is incorporated which enables accurate integration from small volumes of liquid. It is 1000 times more sensitive than the original Beckman instrument. Burning the samples dissolved in acetone increases the sensitivity to 60 000 times, when 3×10^{-13} g of sodium and 10^{-10} g of magnesium can be detected; 1 to 10 μmg amounts of the latter element in biological fluids have been estimated. The instrument can be used as a direct-recording device without integration. Switching arrangements enable it to be used as the original Beckman DU spectrophotometer both for absorptiometry and flame photometry. A.

535.333 : 536.461

3853. EXCITATION OF SPECTRA OF OH IN HYDROGEN FLAMES AND ITS RELATION TO EXCESS CONCENTRATIONS OF FREE ATOMS. M.Charton and A.G.Gaydon.
Proc. Roy. Soc. A, Vol. 245, 84-92 (May 6, 1958).

Measurements have been made of the rotation and vibrational intensity distribution of OH bands in oxygen + hydrogen + nitrogen flames. Simultaneous observations were made of the strength of Na and Li lines and their variation with height in the flame. The anomalously strong excitation of OH bands with $v' = 2$ and 3 is accompanied by selective excitation of the f_1-spin levels of $^2\Sigma^+$ state. This confirms that the anomaly results from an inverse predissociation, associated with an excess of free atoms in the flame gases. This excess is most important for the cooler flames and near the base of these flames. There is also strong excitation of the (0',0) band of OH near the reaction zone and the mechanism for this is briefly discussed. A.

535.333

3854. INTENSITY MEASUREMENTS ON THE O_2^+ SECOND NEGATIVE, CO ÅNGSTRÖM AND THIRD POSITIVE AND NO γ AND β MOLECULAR BAND SYSTEMS. D.Robinson and R.W.Nicholls.
Proc. Phys. Soc., Vol. 71, Pt 6, 957-64 (June, 1958).

Relative band intensities of the Second Negative system of O_2^+, the Ångström and Third Positive systems of CO, and the γ- and β-systems of NO were measured. They were interpreted with the aid of the Franck–Condon factors $q_{v'v''}$ and the r-centroids $r_{v'v''}$ to show the variation of the electronic transition moment $R_e(r)$ with internuclear separation r. Arrays of the relative vibrational transition probabilities $p_{v'v''}$ and the intensities I_∞ at infinite temperature were thereby derived for these systems. A.

535.333

3855. INFRARED EMISSION SPECTRUM OF METHANE AT 3.3 MICRONS. E.K.Plyler and L.R.Blaine.
J. Res. Nat. Bur. Stand., Vol. 59, No. 5, 317-18 (Nov., 1957).

The emission spectrum of methane from the flame of a Bunsen burner was observed in the region from 2820 to 3180 cm^{-1}. Many lines were measured in the P-, Q-, and R-branches. The P-branch was observed to P-28 and the R-branch to R-17. The spectrum was observed from the inner cone of the flame, and with a rich fuel mixture the P-12 line was most intense. This intensity distribution indicated a temperature of about 1200°K for the heated gas. A.

535.338.334 : 537.56

3856. THEORY OF BROADENING OF SPECTRAL LINES IN PLASMA. V.I.Kogan.
Dokl. Akad. Nauk SSSR, Vol. 118, No. 5, 907-10 (1958). In Russian.

The Stark effect becomes significant compared to other (e.g. Doppler) broadening mechanisms under plasma conditions. It is therefore necessary to retain higher powers of the electric field in discussing broadening in plasma; the effect of this on the spectral shape formula is discussed. J.W.Gardner

535.338.334

3857. WIDTH OF THE GREEN MERCURY LINE FROM A 198-ISOTOPE LAMP. H.von Klüber.
Nature (London), Vol. 181, 1007-8 (April 5, 1958).

Experience with, and optimum operating conditions of,a

commercial Hg^{198} lamp run for several hundred hours during the past seven years as a line-width calibrating device are discussed. The half-width of the green line, determined photographically with a Fabry–Perot interferometer, was found to be 0.006-0.007 A, which is very close to the Doppler half-width (0.0055 A) at room temperature. R.W.Nicholls

535.338.334 : 537.564

SHIELDING CORRECTION TO HOLTSMARK'S THEORY OF LINE BROADENING. See Abstr. 3197

535.34.03

3858. THE XENON HIGH-PRESSURE ARC AS A SPECTROPHOTOMETRIC STANDARD. A.Bauer and P.Schulz.
S.B. Heidelberg. Akad. Wiss. (math. nat. Kl.), 1956-57, No. 4, 428-34. In German.

Details are given of its construction and operational characteristics. Its performance in the u.v. is compared with that of high-purity carbon and hydrogen arcs. D.R.Barber

535.34.07

3859. THE HAPPEL RADIATION LABORATORY. H.Kienle.
S.B.Heidelberg. Akad. Wiss. (math. nat. Kl.), 1956-57, No. 4, 357-61. In German.

Description of the instrumental equipment and lay-out used for research in absolute spectrophotometry. D.R.Barber

535.34.07 : 535.343

3860. INFRARED MEASUREMENTS WITH A SMALL GRATING FROM 100 TO 300 MICRONS. E.K.Plyler and L.R.Blaine.
J. Res. Nat. Bur. Stand., Vol. 60, No. 1, 55-7 (Jan., 1958).

Good resolution was obtained with a small grating in the region from 100 to 300 μ. A high-pressure mercury lamp, having a quartz inner envelope, was used as a source and a Golay cell as a detector. The radiation was reflected from three filtering plates before passing through the entrance slit. This filtering served to reduce the stray radiation to about 5%. A.

535.34.07

3861. A DESIGN FOR A MULTI-CHANNEL INFRA-RED SPECTROMETER USING TRANSISTOR ELECTRONICS.
D.G.Avery and R.C.Bowes.
J. sci. Instrum., Vol. 35, No. 6, 212-16 (June, 1958).

A number of InSb photoconductive cells are placed in the plane of the spectrum, each acting as its own "exit slit" and receiving light of different wavelengths. The output from each can be handled separately, or they can be coupled to record the difference in intensity at two wavelengths. A large number of ways of using these outputs are feasible, and the instrument was constructed to demonstrate the principles, rather than to solve any particular problem. A.

535.34.07

3862. A HIGH SPEED INFRA-RED SPECTROMETER FOR THE REGION 0.8-3.0μ.
O.D.Dmitrievskii, V.S.Neporent and V.A.Nikitin.
Optika i Spektrosk., Vol. 3, No. 2, 180-1 (1957). In Russian.

A system using a PbS cell, a rotating mirror and a LiF prism or grating spectrometer is briefly described. A scan rate of 100 μ/sec is obtained. Typical spectral traces are shown. L.Bovey

535.34.07

3863. CHARACTERISTICS OF AN INFRARED SPECTROMETER WITH PRISMS AND GRATINGS.
C.Deloupy, A.M.Vergnoux and F.Rouquayrol.
Rev. Opt., Vol. 37, No. 3, 113-30 (March, 1958). In French.

Expressions are given for the resolution, dispersion and energy transmitted. A number of absorption curves are given to show the performance of an instrument fitted with gratings. Multi-pass prism systems are discussed. G.F.Lothian

535.343 : 539.19

3864. THE TRIPLET STATE IN FLUID MEDIA.
G.Porter and M.W.Windsor.
Proc. Roy. Soc. A, Vol. 245, No. 1241, 238-58 (1958).

Absorption spectra of the triplet states of a variety of organic molecules were observed in fluid solutions at normal temperatures. Triplet–triplet spectra are given for thirty-two molecules and, for ten of these, absolute extinction coefficients and oscillator strengths have been measured. In most cases several distinct electronic transitions were found and the energy levels and oscillator strengths of these transitions are compared with the results of molecular orbital calculations for the first five linear polyacenes. Triplet-state lifetimes have been measured for naphthalene and anthracene in a wide range of solvents and the effect of dissolved gases, particularly oxygen, on these lifetimes is described. A.

535.343

3865. ABSORPTION SPECTRUM OF CRYSTALLINE ANTHRACENE. MEASUREMENTS ON THE ABSORPTION EDGE.
J.Ferguson and W.G.Schneider.
J. chem. Phys., Vol. 28, No. 5, 761-4 (May, 1958).

The absorption spectrum of single sublimation flakes of anthracene was redetermined with a view to investigating the b-polarized absorption edge. From measurements at room temperature on crystals of known thickness and also from spectra at 77° and 4°K it is established that the major part of this absorption takes place in a region of about 50 layers below the crystal surface. The crystal energy levels are then split to a much greater extent that in the main body of the crystal, and it is suggested that this occurs because of some slight crystal structure modification. The weaker absorption lines which also occur on the absorption edge are taken to represent transitions in molecules located near or at imperfections. A.

535.343 : 535.372

3866. ABSORPTION AND FLUORESCENCE SPECTRA OF CRYSTALLINE PYRENE. J.Ferguson.
J. chem. Phys., Vol. 28, No. 5, 765-8 (May, 1958).

The spectra were measured at room temperature and 77°K. Only the first absorption region could be studied because of crystal thickness but a Davydov splitting of about 18 cm^{-1} was detected with the a polarization at higher energy than the b polarization. Calculations of the splitting (dipole–dipole approximation for the intermolecular potential) give 23 and 13 cm^{-1}, respectively, for the B_{2u} and B_{3u} levels with the observed sense, and so it is not possible to decide between two possible assignments from theory. The polarization ratio shows that mixing with a higher level of opposite polarization is present and this is consistent with the only theoretical prediction of energy levels in the molecule. The fluorescence is displaced to long wavelengths from the absorption spectrum and is a broad band with a maximum which is further displaced on cooling the crystal. The band has been interpreted as a charge-transfer transition involving the molecules grouped in pairs in the crystal. A.

535.343

3867. PERTURBATION OF ELECTRONIC RESONANCE SPECTRA BY FOREIGN GASES UNDER HIGH PRESSURE.
J.Robin, R.Bergeon, L.Galatry and B.Vodar.
Disc. Faraday Soc., No. 22, 30-8 (1956).

Absorption spectra of resonance lines of the alkali metals, Hg and some other metals were observed in foreign gases at pressures up to 1200 atm and higher, and at temperatures up to 1200°C. By introducing an interaction potential of the Lennard-Jones type in the Margenau statistical theory, calculations of lines shapes and shifts were made using an electronic computer. Qualitatively, the role of the repulsive forces is shown directly in some cases by the observed reversal of the direction of the shift (from red to blue). Quantitatively the agreement between theoretical and experimental values is fairly good, with only one arbitrary parameter (the coefficient of the repulsive term); in addition, some information about the interaction with excited states may be obtained from these measurements. An accurate comparison of the line shapes gives some data on the radial distribution function in the compressed gases. In addition to the perturbed normal resonance frequencies, other satellite bands were observed, which become very intense at the highest pressures; a survey of the data concerning these bands is presented, and their origin is tentatively ascribed to "non-adiabatic transitions". A.

535.343 : 539.18

SPECTRA OF DIVALENT Ni AND Co IN CUBIC CRYSTALLINE FIELDS. See Abstr. 3398-9

535.343

3868. FREQUENCY SHIFT IN AMMONIA ABSORPTION DUE TO FOREIGN GASES. K.Matsuura, Y.Sugiura and G.M.Hatoyama.
J. Phys. Soc. Japan, Vol. 12, No. 7, 835 (July, 1957).

Frequency shifts per mm of Hg partial pressure are reported for thirteen vapours, of which seven are organic, and are compared with theoretical predictions based upon a dipole–dipole interaction model. Theory and experiment differ by an order of magnitude. R.W.Nicholls

535.343

3869. INFRA-RED SPECTRA OF GASEOUS MIXTURES UNDER HIGH PRESSURE. R.Coulon, L.Galatry, J.Robin and B.Vodar.
Disc. Faraday Soc., No. 22, 22-9 (1956).

The regular pressure range is up to 1200 atm, but an apparatus for 6000 atm was developed. The measurements were concerned particularly with mixtures of a polar gas (hydrogen halide) with a non-polar gas (H_2, N_2, O_2, A). The following effects were observed: (1) appearance of a Q-branch in the vibration-rotation spectrum of the hydrogen halide; (2) rapid increase of the forbidden vibrational band of the non-polar molecule under the influence of the polar molecules; (3) simultaneous transitions in a mixture of HCl and H_2, giving rise to an absorption band at a frequency equal to the sum of the vibrational frequencies of the two separate molecules. In addition to the role played by the atomic distortion moments, the particularly strong effects of the dipole (and also at higher pressures of the quadrupole) moments have been described in terms of a simple theoretical concept taking into account the induced moments. A.

535.343 : 537.311.33

INFRARED ABSORPTION IN N-TYPE SILICON. See Abstr. 3122

535.343 : 539.19

ATOMIC POLARIZATION AND INFRARED ABSORPTION. See Abstr. 3433

535.343 : 539.19

3870. VIBRATIONAL SPECTRA AND THERMODYNAMIC PROPERTIES OF ClF_3 AND BrF_3.
H.H.Claassen, B.Weinstock and J.G.Malm.
J. chem. Phys., Vol. 28, No. 2, 285-9 (Feb., 1958).

The Raman and infrared spectra of ClF_3 and BrF_3 were studied. The spectra of ClF_3 give strong support for a planar "T" shaped molecular model. The spectra of BrF_3 are less complete but are sufficiently similar to that of ClF_3 to confirm a like shape for this molecule. The fundamental vibrational frequencies of ClF_3 observed for the vapour are 326(a_1), 364(b_2), 434(b_1), 528(a_1), 703(b_1), and 752(a_1) cm^{-1}. S^0 for ClF_3, calculated statistically at the boiling point, 11.75°C, is 66.60 cal $mole^{-1}$ deg^{-1} compared to the value of 67.04 obtained from a revised calculation of this quantity from available thermal data. For BrF_3 only two fundamental frequencies were observed in the vapour, 613(b_1) and 674(a_1) cm^{-1}; the others were estimated by a normal coordinate calculation. S^0 for BrF_3 calculated statistically is 70.86 cal $mole^{-1}$ deg^{-1} at 43.11°C compared to a value of 71.90 calculated from available thermal data. Tables of the thermodynamic functions of ClF_3 and BrF_3 from 250 to 1000°K are given. A.

535.343

3871. VIBRATIONAL SPECTRA OF BBr_3 AND BI_3.
W.Wentink, Jr and V.H.Tiensuu.
J. chem. Phys., Vol. 28, No. 5, 826-38 (May, 1958).

The preparation and handling of high purity boron tribromide (BBr_3) and boron triodide (BI_3) are described. The infrared absorption spectra of BBr_3 in the gas, liquid, and CS_2-solution phases and of BI_3 in the gas, CS_2-solution, and solid phases at room temperature are presented and analysed. The observed BI_3 spectrum is consistent with the expected planar configuration. The hitherto unpublished fundamental vibrational frequencies for BI_3 are used along with those for BF_3, BCl_3, and BBr_3 in a uniform force constant calculation based on a modified valence force potential. The fundamental frequencies for these four molecules should prove useful in testing various potential functions and the force constants should be valuable for predicting the vibrational fundamental frequencies in molecules such as $BClI_2$ and BBr_2I. The bond stretching force constant for the boron–iodine bond is 1.95×10^5 dynes/cm. The boron–iodine distance in BI_3 is discussed and a tentative value of 2.10 A is proposed. A.

535.343 : 535.337

3872. EFFECT OF PRESSURE IN CYANIDE AND CARBONYL SPECTRA IN SOLUTION. R.R.Wiederkehr and H.G.Drickamer.
J. chem. Phys., Vol. 28, No. 2, 311-16 (Feb., 1958).

The C=N vibration of CH_3CN was studied in a series of solvents, mostly substituted methanes, to 10 000 atm pressure. Shapes of the curves of frequency v. pressure can be predicted reasonably well from a model which considers the interaction of each bond of the solvent molecule with the CN bonds. It is possible to estimate the relative contributions of dispersion, orientation, induction, and repulsion forces to the net shift. Similar measurements and calculations were made for the C=O vibration in a series of compounds, using CS_2 as the solvent. In this case, induction forces account for 5% of the observed interaction. A.

535.343

3873. THE CALCULATION OF SOME INFRA-RED INTENSITIES.
C.A.Coulson and M.J.Stephen.
Trans Faraday Soc., Vol. 53, Pt 3, 272-81 (March, 1957).

The i.r. intensities of some of the vibrations of the molecules acetylene, ethylene and benzene were calculated quantum mechanically. The electronic distribution in the molecules is described by a molecular-orbital-type wave-function, which is used to determine the derivatives of the dipole moment with respect to the various internal co-ordinates. These derivatives are functions of the degree of bond following and hybridization change taking place during the vibration. On comparison of the calculated values with the observe values in a number of cases it is possible to make a satisfactory allocation of signs to the dipole moment derivatives. The absolute magnitudes of these derivatives agree reasonably well, but not perfectly, with the experimental values. The limitations of any theory, in which the total molecular dipole moment is divided into components of fixed magnitude associated with particular bonds, are stressed. A.

535.343 : 535.337

3874. STARK EFFECT FROM 1.1 TO 2.6 MILLIMETERS WAVELENGTH: PH_3, PD_3, DI, AND CO. C.A.Burrus.
J. chem. Phys., Vol. 28, No. 3, 427-9 (March, 1958).

The Stark effect was observed in the microwave rotational spectra of PH_3 and PD_3 at 1.1 and 2.1 mm wavelength, respectively, in DI^{127} at 1.5 mm, and in $C^{12}O^{16}$ at 2.6 mm. The $J = 1 \rightarrow 2$ transition of PD_3 was observed at 1.08 mm. Analysis of the data yields values of the electric dipole moment, μ, as follows: PH_3, 0.578 ± 0.010 debye; DI, 0.316 ± 0.010 debye; and CO, 0.112 ± 0.005 debye. The centrifugal stretching constants, D_J and D_{JK}, for PD are found to be 0.80_0 Mc/s and 1.3_1 Mc/s respectively. A.

535.343

3875. PRECISE FREQUENCY OF THE 3,3 INVERSION LINE OF AMMONIA. K.Shimoda.
J. Phys. Soc. Japan, Vol. 12, No. 5, 558 (May, 1957).

The precise frequency measured on an absorption type Stark--Zeeman ammonia clock (23 870 131.05 ± 0.05 kc/s) has been compared with precise measurements using a molecular beam maser oscillator (23 870 129.42 ± 0.05 ± 0.12 kc/s). The differences between them have been interpreted in terms of different populations of the quadrupole levels $F_1 = 2,3,4$. R.W.Nicholls

535.343.07

3876. AN INTERFEROMETRIC METHOD FOR THE CALIBRATION OF INFRA-RED SPECTROMETERS.
M.P.Lisitsa and V.N.Malinko.
Optika i Spektrosk., Vol. 3, No. 3, 294-6 (1957). In Russian.

Thin, parallel-sided plates of rock salt are used to produce interference fringes, the position of whose peaks can be calculated. With several known standard wavelengths, an absolute calibration graph can be obtained. L.Bovey

535.343.9 : 535.375.56

3877. HIGH RESOLUTION RAMAN SPECTROSCOPY OF GASES. XI. SPECTRA OF CS_2 AND CO_2. B.P.Stoicheff.
Canad. J. Phys., Vol. 36, No. 2, 218-30 (Feb., 1958).

For Pt X, see Abstr. 9091 (1957). The vibrational Raman spectra of CS_2, $C^{12}O_2$, and $C^{13}O_2$, consisting of the strong Fermi diad ν_1, $2\nu_2$, were photographed with a 21 ft grating. In the spectrum of CS_2, 12 additional sharp Q branches were observed in the region of the diad; three are due to isotopic molecules and the remainder are "hot" bands. The rotational structure of the strong ν_1 band was also obtained. These measurements, together with i.r. data, are used to determine the vibrational constants of CS_2. The pure rotational spectrum of CS_2 with rotational lines up to $J = 94$, yields the constants $B_{000} = 0.10910 \pm 0.00005$ cm^{-1}, $D_{000} = 1.0 \times 10^{-8}$ cm^{-1}, and $r_0(C{=}S) = 1.5545 \pm 0.0003$ A. For $C^{13}O_2$, the rotational structure of the diad was analysed, and the results are in agreement with recent i.r. data. A.

535.343.9 : 535.375.5

3878. RAMAN SPECTRUM OF GASEOUS CO_2.
Yu.I.Kotov, V.I.Tyulin and V.M.Tatevskii.
Optika i Spektrosk., Vol. 4, No. 2, 271-2 (1958). In Russian.

From the Raman spectrum obtained on a grating instrument with a dispersion of 6.7 A/mm, the rotational constant B_0 was found to be 0.3895 ± 0.0004 cm^{-1}, in good agreement with the value from i.r. data. L.Bovey

535.345 : 537.312.5 : 537.311.33

3879. OPTICAL ABSORPTION BY FREE HOLE—ELECTRON PAIRS LIBERATED BY THE PHOTOELECTRIC EFFECT IN A GERMANIUM SINGLE CRYSTAL. F.Desvignes.
C.R. Acad. Sci. (Paris), Vol. 246, No. 12, 1824-7 (March 24, 1958). In French.

Reports the construction and testing of the optical analogue of the triode. Light in the absorption band of germanium produces hole—electron pairs which give rise to increased absorption for light of wavelength beyond the edge. By using two different frequencies for the incident light, a modulated output can be achieved. C.A.Hogarth

535.345

3880. ABSORPTION BAND DUE TO COLLOIDAL SILVER.
R.Yokota and K.Shimizu.
J. Phys. Soc. Japan, Vol. 12, No. 7, 833 (July, 1957).

A glass containing Ag and Ce develops a narrow absorption band at λ = 4100 A on irradiation with ultraviolet and subjection to heat treatment. The absorption curve agrees approximately with that calculated from the absorption coefficients of Ag and the refractive indices of Ag and glass. G.F.Lothian

535.345.6 : 535.417

3881. A NARROW-BAND OPTICAL FILTER TO ISOLATE THE 4245 A SPECTRAL REGION. R.P.Thorne and R.F.Warren.
J. sci. Instrum., Vol. 35, No. 5, 186 (May, 1958).

A dielectric interference filter, with side-bands removed by solutions of sodium nitrite and cuprammonium, has a peak transmission of 65% and a half-width of 100 A. It is used with an echelle grating for the high-resolution spectroscopy of uranium isotopes. G.F.Lothian

535.345.6

3882. COLOUR FILTERS FOR THE 4358 A LINE OF THE MERCURY DISCHARGE SPECTRUM. A.Burawoy and A.G.Roach.
Nature (London), Vol. 181, 762-3 (March 15, 1958).

A two-component solution transmits about 0.8 of λ = 4358 A, and 10^{-4} or less of the other visible mercury lines. It has good stability to mercury light. G.F.Lothian

535.37

3883. ON THE EXCITING WAVE LENGTH DEPENDENCE OF THE RATIO OF THE YIELDS OF PHOSPHORESCENCE AND FLUORESCENCE. R.Bauer and A.Bączyński.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 6, No. 2, 113-17 (1958).

The variation of the ratio of phosphorescence to fluorescence yields for fluorescein in boric acid is measured. The results are explained in terms of energy—configuration curves for ground, excited and metastable states of the centres. G.F.J.Garlick

535.37 : 539.219

3884. INVESTIGATIONS IN THE $CuGaS_2$—ZnS AND $AgGaS_2$—ZnS SYSTEMS. E.F.Apple.
J. Electrochem. Soc., Vol. 105, No. 5, 251-5 (May, 1958).

$CuGaS_2$ and ZnS form solid solutions over the entire range with some evidence for compound formation at $33\frac{1}{3}$ mole % $CuGaS_2$. Emission under 3650 A excitation shifts from green to red with increase in $CuGaS_2$ concentration. Samples with more than 20% $CuGaS_2$ do not luminesce at room temperature but, at −195°C, fairly bright emission is observed with up to 95% $CuGaS_2$. $AgGaS_2$ is soluble in ZnS to about 5-10 mole %, above which separation of Ag_2S is observed. Emission under 3650 A excitation shifts from the blue (0.01% $AgGaS_2$) to yellow (10% $AgGaS_2$). A.

535.37 : 539.2

3885. EFFICIENCIES AND PHOTOFRACTIONS FOR SODIUM-IODIDE CRYSTALS. W.F.Miller, J.Reynolds and W.J.Snow.
Rev. sci. Instrum., Vol. 28, No. 9, 717-19 (Sept., 1957).

Efficiencies and photofractions for mono-energetic gamma rays, from a broad parallel beam, incident on sodium iodide crystals of various sizes, were calculated by the Monte Carlo method. The calculations were carried out for photon energies of 0.279, 0.661, 1.33, 2.62 and 4.45 MeV; the crystals considered were right circular cylinders with radii of 1.0, 2.0, 4.0, 8.0, 12.0 and 16.0 in. and, for each radius, crystals of heights 1.0, 2.0, 4.0 and 8.0 in. The effect of the escape of annihilation gammas from the crystal was taken into account in the Monte Carlo calculation; however, no correction was made for escape of bremsstrahlung. This correction is important only at the largest energies and for the smallest crystals where it affects the photofraction by a few percent. A.

535.37 : 539.2

3886. EFFICIENCIES OF SODIUM IODIDE CRYSTALS.
A.L.Stanford, Jr and W.K.Rivers, Jr.
Rev. sci. Instrum., Vol. 29, No. 5, 406-10 (May, 1958).

Efficiencies for mono-energetic gamma rays, emanating from an axial point source and incident on sodium iodide crystals of 1.5 in. diameter and of various heights, were calculated by numerical integration methods. The crystals considered are right circular cylinders of heights 0.125, 0.25, 0.375, 0.50, 0.75, 1.5, 2.0 and 3.0 in. Seventeen photon energies in the range from 0.025 to 10.0 MeV were used. Fourteen distances from source to crystal face in the range from 0.1 to 50.0 cm were used. Efficiencies for crystals of diameters other than 1.5 in. may be obtained from these results. Relative photoelectric efficiencies were not calculated. A.

535.371 : 620.11

3887. OPTICAL FLUORESCENCE IN NON-DESTRUCTIVE TESTING. W.A.Runciman.
Brit. J. appl. Phys., Suppl. No. 6, (Physics of non-destructive testing S34-S36 (1957).

Fluorescence techniques are used for the detection of X-rays, and also in the examination of metals. Magnetic materials can be tested by the fluorescent magnetic particle method, and the surface of any metal can be inspected for cracks using the fluorescent penetrant method. The main properties of the luminescent centre are outlined with a view to obtaining a deeper understanding of the processes involved, and to applying them to further types of problem. Examples of fluorescent substances include pure and impurity-activated solids, both organic and inorganic. Metals are non-fluorescent, but materials which can be directly studied by fluorescence include some glasses, ceramics and textiles. A

535.371

3888. ON THE ANTI-STOKES FLUORESCENCE YIELD IN GLUCOSE AND COLLODIUM RIGID SOLUTIONS. R.Drabent.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 5, No. 12, 1131-6 (1957).

Measurements were made of the relative fluorescence yield of rigid solutions of rhodamine B in glucose and collodium, as a functi of excitation wavelength. The yield decreases with increasing wavelength beyond 6000 A (the anti-Stokes region). J.B.Birks

535.371

3889. DEPENDENCE OF POLARIZATION OF FLUORESCENCE ON THE CONCENTRATION OF LUMINESCENT MOLECULES IN PLEXIGLAS PHOSPHORS. M.Czajkowski and J.Grzywacz.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 6, No. 2, 107-11 (1958).

The degree of polarization of the solute-molecule emission rises with concentration of naphthacence or eosin in methyl methacrylate polymer which is contrary to the usual concentration dependence. The result is explained by the competition between indire excitation via the solvent (unpolarized emission) and direct excitation of the solute (giving polarized emission) which increases with solute concentration. G.F.J.Garlick

535.371 : 535.66

3890. MODE OF ACTION OF FLUORESCENT WHITENING AGENTS AND MEASUREMENT OF THEIR RELATIVE EFFICIENCY.
E.Allen.
J. Opt. Soc. Amer., Vol. 47, No. 10, 933-43 (Oct., 1957).

Fluorescent whitening agents improve the appearance of cloth or paper through two separate visual effects, a bluing effect and a lightening effect; the former is much more important than the latter. For any one shade of whitener, both the bluing and lightening effects are directly proportional to the effective fluorescence (defined here as the sum of the tristimulus values of the fluorescent light from the dyeing). However, when whiteners of different shades are compared at the same effective fluorescence, the greener-shade whitener has more of a lightening effect, but the redder-shade whitener has more of a bluing effect. These two advantages, one for the greener shade and the other for the redder shade, almost exactly cancel each other, so that at the same effective fluorescence both whiteners improve the cloth to the same degree. Effective fluorescence, as here defined, is therefore a reliable indication of whitening power irrespective of shade. This quantity may be measured on a fluorimeter, but an appropriate correction factor must be applied when two different whiteners are being compared. A.

535.371

891. PHOSPHORS SENSITIVE TO INFRARED RADIATION. .Rezníček and Z.Švec.
laboproudý Obzor, Vol. 18, No. 5, 296-9 (1957). In Czech.

The phosphor consisted of a mixture of SrS, three activators Ce, Sm and Pb) and a LiF binder. It was found that the optimum ight emission was achieved by keeping the concentration of the ctivators (in an otherwise pure SrS) to within 10^{-3} to 10^{-2} mol%. Before being used, the phosphor was sensitized by u.v., β- and -irradiation. It then emitted green light and its maximum sensi- ivity occurred at a wavelength of 10200 A. R.S.Sidorowicz

535.372 : 535.333

892. THE FLUORESCENCE AND EMISSION SPECTRA OF THE HREE ISOMERIC FLUORO-TOLUENES.
.Suryanarayana, I.Achyuta Rao and V.Ramakrishna Rao.
rans Faraday Soc., Vol. 53, Pt 12, 1570-7 (Dec., 1957).

The near u.v. fluorescence and emission spectra of the three somers in the vapour phase were obtained and nalysed in coordination with each other. The molecular vibrational requencies obtained from this analysis are correlated with the alues from the Raman and near u.v. absorption spectra. Possible ssignments are also suggested. A.

535.376

893. LUMINESCENCE PRODUCED IN AIR BY POLONIUM-210 -PARTICLES. R.W.Nicholls and E.M.Reeves.
lature (London), Vol. 180, 1188-9 (Nov. 30, 1957).

The spectrum (3800-8000 A) of the luminosity was obtained hotographically with an exposure time of 10 days at a camera perture of f/1. It consisted solely of the bands of N_2^+ (first egative system) and N_2 (second positive system). No evidence as seen of atomic lines nor of the N_2 first positive system. It is uggested that the N_2^+ bands were excited in primary ionizing -particle collisions and that the N_2 bands were excited by the nergetic electrons liberated thereby. Absence of the N_2 first ositive bands was explained in terms of collision de-excitation y O_2. R.W.Nicholls

535.376

894. α-RAY INDUCED LUMINESCENCE OF GASES.
.O.Brown and N.Miller.
rans Faraday Soc., Vol. 53, Pt 6, 748-59 (June, 1957).

A study, using a photomultiplier tube, of the luminescence duced by a fixed source of Po^{210} in argon, carbon dioxide and nitro- en, together with mixtures of these gases with quenching vapours, owed that the phenomenon was for the most part explicable on cur- ent ideas as to α-ray excitation and energy transfer by collision. some cases energy transfer resulted in luminescence of the minor omponent where that of the major lay in the far u.v. and was thus ot detectable. It is suggested that an extension of these techniques sing higher source strengths and improved resolution would prove eful in the study of the emission spectra of molecules. A.

535.376 : 539.166

895. GAMMA-DETECTION EFFICIENCY OF ORGANIC HOSPHORS. K.I.Roulston and S.I.H.Naqvi.
ucleonics, Vol. 15, No. 10, 86 (Oct., 1957).

A nomogram giving the number of energy transfers greater an that equivalent to the discriminator bias setting, as a function the incident gamma-energy. R.D.Smith

535.376 : 538.61 : 537.311.33

896. ON AN ELECTROMAGNETOLUMINESCENCE EFFECT IN ERMANIUM. M.Bernard and J.Loudette.
R. Acad. Sci. (Paris), Vol. 246, No. 8, 1177-80 (Feb. 24, 1958).
French.

A single-crystal slab of Ge with a field of 4800 oersted applied ong one axis and a rectified d.c. (18 V peak) at right angles is found emit infrared in the range 1.7 - 2.6 μ and in a direction perpen- cular to the two fields. It is ascribed to volume recombination of ectrons and holes near the surface. S.T.Henderson

535.376 : 539.1.07

ORGANO-BORON LUMINESCENT COMPOUNDS.
e Abstr. 3276

535.377

97. THE THERMOLUMINESCENCE OF GLASSES. T.Kikuchi.
Phys. Soc. Japan, Vol. 13, No. 5, 526-31 (May, 1958).

The thermoluminescence of soda silicate glass and fused quartz, well as of crystalline quartz, was observed below room temper- ure. The glow curves of glasses have broad bands without any ructure. The luminescence shows the slow decay continuing for more than 10 min at any fixed temperature between 100° and 350°K. The dependence of these curves on the irradiation temperature and on the X-ray dose, and the effect of the heat treatments were studied. The decay curves, which do not obey the simple monomolecular or bimolecular law, are analysed by the model in which the trapping levels are distributed continuously and uniformly beneath the conduction band. A discussion on the relation between the trapping centres and the random network structure of the glasses is presented. A.

535.377

3898. ON THE MECHANICAL ACTIVATION OF THERMO-LUMINESCENCE IN CALCITE. A.Debenedetti.
Nuovo Cimento, Vol. 7, No. 2, 251-4 (Jan. 16, 1958).

Thermoluminescence peaks at 230°C were obtained with synthetic pure calcite after bombardment with 25 kV X-rays. On compressing a sample for 12 h at 700 kg/cm^2, or grinding in a mortar, peaks were obtained at 360° and 424°C. J.Franks

535.379 : 541.15

SONOLUMINESCENCE OF AQUEOUS SOLUTIONS.
See Abstr. 3548

535.391

3899. MULTILAYER DIELECTRIC COATINGS WITH A HIGH REFLECTION COEFFICIENT IN A GLASS SURFACE. T.N.Krylova.
Optika i Spektrosk., Vol. 4, No. 2, 217-24 (1958). In Russian.

Approximate graphical methods are discussed for the calculation of reflection coefficients for various numbers of layers. Illustrative curves are given for 3 to 11 coatings of titanium and silicon oxides, chemically deposited. The variation of the coefficient with wavelength is also discussed and illustrated. L.Bovey

535.391

3900. ON THE REFLECTION COEFFICIENTS OF GERMANIUM AND SILICON CRYSTALS.
V.S.Vavilov, A.A.Gippius and M.M.Gorshkov.
Zh. tekh. Fiz., Vol. 28, No. 2, 254-5 (1958). In Russian.

The proportion of incident monochromatic radiation (0.4 to 1.1 μ) reflected or scattered from the surface of a specimen was determined using an integrating sphere coated on the inside with MgO. An MgO disk was used for calibration. The errors were estimated to be $< 2\%$. Results are given for Ge and Si specimens after various surface treatments. K.F.Hulme

535.393 : 537.311.62

THE ANOMALOUS SKIN EFFECT AND THE INFRARED PROPERTIES OF SILVER AND ALUMINIUM. See Abstr. 3129

535.417 : 535.34.07

3901. CALCULATION OF THE INTEGRAL FILTER FACTOR FOR A FABRY—PEROT SPECTROMETER. R.Chabbal.
J. Rech. Cent. Nat. Rech. Sci., No. 39, 77-106 (June, 1957).
In French.

The integral filter factor is defined as that measure of a spectrometer which is capable of isolating a narrow spectral band in a continuous spectrum. The treatment refers to the use of the Fabry—Perot primarily in absorption. The property of the instrument and the properties of Fabry—Perot interferometers in series are studied from this point of view. If the reflections between interferometers are not eliminated the filter factor is reduced. It is advantageous therefore to incline the interferometers relative to each other. The factor is independent of absorption of the reflecting films. Curves are given for theoretical factor values and are shown to be confirmed by actual observation. Under certain conditions the Fabry—Perot interferometer can possess a factor comparable to that of a prism or a grating. S.Tolansky

535.417 : 531.715.1/.2

OPTICAL METHODS OF NON-DESTRUCTIVE TESTING.
See Abstr. 3749

535.42 : 534.321.9

3902. THE DIFFRACTION OF LIGHT BY PROGRESSIVE WAVES OF FINITE AMPLITUDE. K.L.Zankel and E.A.Heidemann.
Naturwissenschaften, Vol. 45, No. 7, 157 (1958).

Experimental confirmation is reported of the theory of diffraction of light by ultrasonic waves of finite amplitude (1 Mc/s) according to which the intensities of equal positive and negative orders of diffraction should differ owing to higher harmonics in the sound wave. See also Abstr. 3849 (1958). W.T.Welford

535.421 : 539.27

3903. AN ELECTRON MICROSCOPE METHOD FOR THE OBSERVATION OF THE PROFILE OF DIFFRACTION GRATINGS.
V.N.Vertsner, L.V.Degteva and Yu.S.Kharionovskii.
Optika i Spektrosk., Vol. 3, No. 2, 181-3 (1957). In Russian.

Two techniques for examining the grating surfaces ruled on glass and on aluminium are briefly described. Silver or collodion replica coatings were made in the two cases respectively, and photographs obtained by such methods are reproduced. L.Bovey

535.43 : 548

3904. LIGHT SCATTERING BY NEARLY PERFECT CRYSTALS. O.Theimer and C.A.Plint.
Ann. Phys. (New York), Vol. 3, No. 4, 408-22 (April, 1958).

The theory of light scattering by crystals is developed in a form adapted to modern theories of lattice imperfections. In addition to thermal scattering, configurational scattering of two different types is considered: (1) scattering by macroscopically homogeneous distributions of point imperfections (vacancies, impurities) characterized by their concentration, polarizability, and radial distribution function; (2) scattering by bad regions in the neighbourhood of dislocation lines characterized by their size, shape, and index of refraction. Interpreting recent scattering experiments in terms of this theory one estimates that single crystals of Harshaw sodium chloride have a dislocation density between 10^7 and 10^9 cm^{-2}, an average vacancy concentration between 10^{15} and 10^{17} cm^{-3} and bad regions with an average diameter of about 1000 A and an excess vacancy concentration of about 10^{18} cm^{-3}. A.

535.435 : 535.51

3905. A THEORY OF THE DEPOLARIZATION OF LIGHT SCATTERED BY A DENSE MEDIUM. A.D.Buckingham and M.J.Stephen.
Trans Faraday Soc., Vol. 53, Pt 7, 884-93 (July, 1957).

A general theory of the depolarization of the light scattered elastically by an assembly of interacting molecules is developed. For spherical molecules with dimensions small relative to the wavelength of the light, and for frequencies well below those of the electronic absorption region, a relationship, valid at all densities, between the depolarization and the molecular refraction is established. For polar liquids, a substantial part of the depolarization is shown to depend upon the leading hyperpolarizability tensor describing the initial departure from a linear relationship between the dipole moment and the electric field strength. The Onsager model of a polar liquid leads to a simple expression for the depolarization involving this tensor, and its value for chloroform is estimated from the observed depolarization. The appendix contains a table showing the minimum number of independent quantities required to describe the polarizability and hyperpolarizabilities appropriate to various molecular shapes. A.

535.55

3906. THE PHOTOELASTIC BEHAVIOUR OF CROSS-LINKED POLYMERS. Z.Tuzi, K.Kawata and I.Hori.
Brit. J. appl. Phys., Vol. 9, No. 5, 173-8 (May, 1958).

The photoelastic and mechanical properties of various cross-linked polymers were studied over a wide range of temperature. A large change of the stress-optical coefficient was observed in the second order transition region. At temperatures above that region, suitably cross-linked polymers show a photoelastic behaviour corresponding to nearly perfect entropy-elasticity. The effect of cross-linkage on the stress-optical coefficient has been studied in styrene-divinyl-benzene copolymers. The DVB content affects the coefficient considerably in the entropy-elasticity region, but negligibly in the glassy state. From photoelastic data, the value of the optical anisotropy ($\alpha_1 - \alpha_2$) may be derived. The value of $\Delta n/S$ extrapolated to zero degree of cross-linkage agrees well with that of the linear polymer. Experimental evidence is given that polymers formed by polymerization or addition reactions are preferable to those formed by condensation as materials for the stress-freezing method. A.

535.557

3907. PHOTOELECTRIC FLOW BIREFRINGENCE INSTRUMENT OF HIGH SENSITIVITY. B.H.Zimm.
Rev. sci. Instrum., Vol. 29, No. 5, 360-7 (May, 1958).

A conventional concentric-cylinder flow birefringence instrument was modified by adding a photocell and a rotating disk that scans the annulus with a moving spot of light. In this way the optical intensity pattern formed in the image of the annulus by the combination of polarizer, analyser, and quarter-wave plate is converted into an electrical wave which is then analysed by an electronic device. Full advantage can be taken of the increased sensitivity to birefringence caused by the presence of the quarter-wave plate, since the presence of a bright background, so disturbing to the eye, is not important to the photocell. In effect, the system is converted to a linear dependence on the magnitude of the birefringence, instead of the quadratic one found in the conventional method of observation. The sensitivity is in fact increased by about a factor of ten over the same instrument used in the conventional way, and at the same time measurements are made independent of the visual judgment of the experimenter. The linearity of the system also has considerable advantages when extraneous sources of birefringence are present, as is commonly the case. A.

535.568.1

3908. ELLIPTIC POLARIMETER FOR THE STUDENT LABORATORY: "SPECIMENS" OF ELLIPTICALLY POLARIZED LIGHT. T.B.Brown.
Amer. J. Phys., Vol. 26, No. 3, 183-7 (March, 1958).

The precision approaches that of a research instrument. Experiments with the instrument are simplified by providing the student with "specimens" of elliptically polarized light, made by binding together, with suitable orientation, a Polaroid and a birefringent plate of approximately quarter-wave retardation. Precision is attained by means of an improved form of analyser. The errors encountered with a compensator plate that does not produce exactly quarter-wave retardation are analysed, and a method for taking data is developed, which reduces the final errors to small second-order terms. A.

535.642.2

3909. NEW TABLES FOR THE CALCULATION OF COLOUR COORDINATES. N.V.Lobanova and G.N.Rautian.
Optika i Spektrosk., Vol. 3, No. 1, 77-81 (1957). In Russian.

In the wavelength range from 0.380 to 0.780 μ, and for source temperature A(2854°K), B(4800°K) and C(6500°K), tables are given for: (1) $E(\lambda)_B$, $E(\lambda)_C$; (2) $E(\lambda)_B\,\alpha(\lambda)$, $E(\lambda)_B\,\beta(\lambda)$, $E(\lambda)_B\,\gamma(\lambda)$; (3) $E(\lambda)_C\,\alpha(\lambda)$, $E(\lambda)_C\,\beta(\lambda)$, $E(\lambda)_C\,\gamma(\lambda)$; (4) $E(\lambda)_A\,\beta(\lambda)$, $E(\lambda)_A\,\gamma(\lambda)$, $E(\lambda)_A\,\alpha(\lambda)$; and correspondingly for B and C. All values were calculated in accordance with international conventions and a comparison of filters used in the Russian and the 1931 International Commission (Abstr. 3234/1932) is given. L.Bovey

535.66 : 535.371

RELATIVE EFFICIENCY OF WHITENING AGENTS. See Abstr. 3890

535.7

PHYSIOLOGICAL OPTICS. VISION. See under "Medical science. Human physiology". Decimal classification 612.84

535.8

3910. RANGE FINDERS USING PROJECTED IMAGES. R.E.Stephens.
J. Res. Nat. Bur. Stand., Vol. 60, No. 4, 327-33 (April, 1958).

Two optical range-finders of six-inch base-length were designed and constructed for making measurements to arbitrary points on a model. One measures distances from 2.5 ft to 10 ft, the other from 9.7 ft to 25 ft. The accuracy of all distances is plus or minus one-quarter inch or better. Because of unusual requirements of use, these range-finders operate by projecting two images of a bright cross upon the target, which may be fused into a single image by adjustment of the range knob. A.

535.81 : 771.35

VARIABLE-FOCUS WEAK LENS. See Abstr. 3627

535.822.1 : 548.734

MICROSCOPE USED FOR MEASURING X-RAY POWDER PHOTOGRAPHS. See Abstr. 3580

535.833

3911. ON THE OPTICAL PROPERTIES OF A BIPRISM COMBINED WITH A COARSE GRATING. G.M.Sreekantath and C.A.Verghese.
J. sci. Instrum., Vol. 35, No. 4, 150 (April, 1958).

An arrangement of a biprism and a grating used in front of a telescope is described. The theory of the bands formed in the plane of the eyepiece is given and some general properties are noted. R.W.Fish

535.89 : 535.332 : 537.521.7

3912. THE EMISSION OF LIGHT FROM ELECTRIC DISCHARGES OF MICROSECOND DURATIONS IN GASES AT ATMOSPHERIC PRESSURE. D.P.C.Thackeray.
J. sci. Instrum., Vol. 35, No. 6, 206-12 (June, 1958).

The performances are compared of four types of spark discharge, widely used as light sources of high intensity and short duration. Using the same capacitor and stored energy, electrical and light emission waveforms, and integrated spectra were recorded for each type of discharge. Air sparks (both free and guided across

the surface of an insulator) and argon sparks (both within a jet of argon and enclosed by a quartz capillary tube) were studied in this manner. The results are discussed in terms of the possible applications in fast photography and the photo-irradiation of materials. Particular attention is drawn to the novel properties of the discharge within an argon jet, as this affords a source of high positional stability and repeatability of performance, while retaining the high intensity and small size of other discharges. A.

HEAT

536 : 533.7

3913. TABLES OF THERMAL PROPERTIES OF GASES. J.Hilsenrath, C.W.Beckett, W.S.Benedict, L.Fano, H.J.Hoge, J.F.Masi, R.L.Nuttall, Y.S.Touloukian and H.W.Woolley. Circ. Nat. Bur. Stand., No. 564, 488 pp. (1957).

Tables are given at close temperature intervals for the thermodynamic and transport properties of air, argon, CO_2, CO, H_2, N_2, O_2, and steam. The thermodynamic properties — compressibility factor, density, entropy, enthalpy, specific heat, specific heat ratio and sound velocity — are tabulated for the real gas at pressures up to 100 atm and to temperatures of 600° K for H_2, 1500° K for CO_2, 850° K for steam, and 3000° K for the remainder. The ideal-gas thermodynamic functions are tabulated uniformly to 5000° K. Also tabulated are the vapour pressures and transport properties (thermal conductivity, viscosity, and Prandtl number). These were fitted either semi-theoretically or empirically to the experimental values and are tabulated over the range of the available experimental data. Comparisons of the tabulated values with the existing experimental data are shown in deviation plots, which exhibit the range and distribution of the experimental data as well as their agreement with the tabulated values. A.

536.2 : 537.228

3914. THERMAL CONDUCTION OF LIQUID DIELECTRICS UNDER THE INFLUENCE OF ELECTRICAL FIELDS. S.Mascarenhas, Y.Mascarenhas, M.Ferreira de Souza and R.F.Rabello. An. Acad. Brasil. Ciênc., Vol. 28, No. 1, 95-8 (1956).

Liquid dielectrics subjected to an electrical field show a large increase in thermal conductivity. The phenomenon was investigated in stearic, oleic and palmitic acids by a non-steady-state method, and it is concluded that the effects are not due to Joule heating. F.E.Hoare

536.2 : 537.228

3915. THE ACTION OF HOMOGENEOUS ELECTRICAL FIELDS UPON THE HEAT TRANSMISSION OF LIQUID DIELECTRICS. S.Mascarenhas. An. Acad. Brasil. Ciênc., Vol. 28, No. 1, 99-105 (1956).

Continuing work on this subject (see preceding abstract) a new apparatus, similar to the Lees disk, was used to measure the thermal conductivity of liquid dielectrics with and without an applied electric field. Static conditions allowed the thermal conductivity to be evaluated. A field of 12 500 V/cm increased the thermal conductivity from 4.69 (zero field) to 6.39×10^{-4} (W cm^{-2})/(deg C cm^{-1}) in the case of oleic acid. Since the symmetrical arrangement gives a uniform field the effect cannot be attributed to non-uniformity. It is also shown that Joule heating is too small to account for the observations. F.E.Hoare

536.2 : 537.228

3916. THE EXPERIMENTAL ANALYSIS OF ELECTRO-THERMALCONDUCTIVITY. S.Mascarenhas. An. Acad. Brasil. Ciênc., Vol. 29, No. 3, 329-44 (1957).

Several more materials were examined for effect of electric field on thermal conductivity (see preceding abstracts). These include naphthalene, durene, 2 methyl—naphthalene, penta—methyl—benzene, oleic acid, toluene, benzene, paraffin, beeswax, carnuaba wax, and transformer oils (Univolt 35, XR42 and B30). The effect was found in all the materials, but was much more pronounced in some. The effects of the field and of film thickness were investigated. F.E.Hoare

536.2.01 : 537.228

3917. ON THE THERMODYNAMICAL THEORY OF THERMAL CONDUCTION OF DIELECTRICS UNDER ELECTRIC FIELDS. R.Fieschi. Nuovo Cimento, Vol. 6, No. 5, 1225 (Nov., 1957).

Previous work (Abstr. 7809/1957) is modified for relative orientation of thermal and electrical potential gradients. P.Gray

536.21 : 539.2

3918. THE SECOND-ORDER EFFECT OF FREE ELECTRONS ON LATTICE CONDUCTION [OF HEAT]. I.C.Pyle. Proc. Cambridge Phil. Soc., Vol. 53, Pt 2, 508-13 (April, 1957).

Second-order perturbation theory, in conjunction with the usual treatment of electron—phonon interaction, allows us to calculate the correction to the first-order result for the scattering of phonons by electrons. It is shown that the second-order term is much smaller, and therefore negligible. This justifies the use of the first-order theory in the treatment of the interaction in metals and semiconductors. A.

536.21 : 539.217

3919. THE PROBLEM OF EXTENDING ODELEVSKĬ'S GENERALIZED THEORY OF CONDUCTION TO THERMAL CONDUCTIVITY. Sh.N.Plyat. Zh. tekh. Fiz., Vol. 27, No. 12, 2789-90 (1957). In Russian.

Porous materials are divided into two classes, distinguishing between pores embedded in solid and solid grains surrounded by air. For both classes a "degree of porosity" and a "thermal conductivity of the pores" are assumed to be defined and accessible to measurement. Formulae are quoted by which the thermal conductivity of a material is expressed as a function of the two above parameters and of the thermal conductivity of the solid itself. The formulae are tested experimentally by measurements on materials containing corundum. Agreement is considered to be satisfactory. R.Eisenschitz

536.21 : 539.217

THE PARTIAL DIFFERENTIAL EQUATION FOR HEAT CONDUCTION. See Abstr. 3478

536.21.07

3920. HEAT BRIDGE FOR MEASURING THERMAL CONDUCTIVITY. G.F.Landegren. Amer. J. Phys., Vol. 25, No. 8, 532-4 (Nov., 1957).

The apparatus, which is analogous to the Wheatstone bridge, is for solid material. A.

536.212

3921. THE LATTICE THERMAL CONDUCTIVITY OF A GOLD—PLATINUM ALLOY. J.A.Birch, W.R.G.Kemp and P.G.Klemens. Proc. Phys. Soc., Vol. 71, Pt 5, 843-5 (May, 1958).

Reports results of measurements between 2° and 90° K on an alloy containing 2% Pt, and draws conclusions about the electron—phonon interactions which agree approximately with the Makinson coupling scheme; the effects of heat treatment were also investigated. E.P.Wohlfarth

536.212 : 537.312.62

3922. THE THERMAL CONDUCTIVITY OF LEAD AT LOW TEMPERATURES. H.Montgomery. Proc. Roy. Soc. A, Vol. 244, 85-100 (Feb. 25, 1958).

Thermal conductivity measurements were made on a series of lead specimens between 1 and 4° K, in the superconducting and in the normal states. Both single crystals and polycrystals were studied, and also specimens containing various added impurities. The results in the superconducting state confirm the hypothesis that below about 1.4° K the thermal current is carried entirely by lattice waves, and that these are not scattered by conduction electrons. This conclusion is based upon three pieces of evidence: (1) the thermal conductivity K_S is insensitive to the amount and species of impurity; (2) it depends upon the geometry of the specimen for sufficiently thin specimens; (3) it is sensitive to plastic deformation, which can be explained if the lattice waves are scattered by dislocations. A brief discussion is given of the possible significance of these results in the theory of superconductivity. A.

536.212.2 : 537.312.62

3923. AN INVESTIGATION OF THE THERMAL PROPERTIES OF SUPERCONDUCTORS. I. TIN (DOWN TO 0.15° K). N.V.Zavaritskiĭ. Zh. éksper. teor. Fiz., Vol. 33, No. 5(11), 1085-98 (1957). In Russian.

Measurements were made of the thermal (K) and temperature conductivity ($a^2 = K/c\rho$; where c is the specific heat, and ρ the density) of several samples of tin in the interval from 0.15° to 4° K, from which it was possible to determine the specific heat of tin down to 0.15° K. It is found that below 0.45° K the specific heat is due to the lattice and varies according to Debye's law, with $\Theta_D = 202 \pm 3°$ K. Above 0.45° K the specific heat of the electrons is manifest, depending on the temperature as $C = A(T) \exp(-\alpha T_K/T)$. The free energy of the superconducting electrons below 3° K, determined on the basis of these measurements, may be represented as $F = BT^n \exp(-\alpha T_K/T)$, where $B = 8.7 \times 10^{-4}$ J $g^{-1} mol^{-1} deg^{-n}$,

$n = 2.5 \pm 0.5$, $\alpha = 1.35 \pm 0.1$. The thermal conductivity of tin below 0.3°K for all samples is due to the heat transfer by phonons (one of the samples exhibited a reflection effect of the phonons from the mirror surface). At higher temperatures, the thermal conductivity of electrons appears to vary, in all samples, as $K = \text{const } \exp(-\beta T_K/T)$, $\beta = 1.45 \pm 0.05$. The results obtained are discussed in terms of the presence of an energy gap in the excitation spectrum of superconductors. A.

536.222.08

3924. A RADIAL HEAT-FLOW APPARATUS FOR LIQUID THERMAL CONDUCTIVITY DETERMINATIONS.
A.R.Challoner, H.A.Gundry and R.W.Powell.
Proc. Roy. Soc. A, Vol. 245, No. 1241, 259-67 (1958).

A radial heat-flow apparatus has been constructed in Pyrex glass and used for liquid thermal conductivity investigations. The liquid under test fills the 1.25 mm space between concentric cylinders and a measured quantity of heat flows inwards. After calibration using liquids of known thermal conductivity, new values are obtained for pyridine and three chlorofluorocarbon oils. The apparatus can also be used for direct determinations when allowance is made for the temperature drop occurring in each of the glass walls. For this purpose, a determination of the thermal conductivity of the glass was made using a similar method. A discussion of the results is included. A.

536.23 : 536.71

3925. EQUATION OF STATE AND THERMAL CONDUCTIVITY OF GASES AT HIGH PRESSURES AND ELEVATED TEMPERATURES.
J.Saurel, R.Bergeon, P.Johannin, J.Dapoigny, J. Kieffer and B.Vodar.
Disc. Faraday Soc., No. 22, 64-9 (1956).

Experimental investigations of some thermodynamic properties of compressed gases at elevated temperatures were undertaken. The method employed is the "internal heating" method, where the electrical furnace is within the high-pressure bomb, the walls of this bomb being water-cooled. The p, v, t measurements were made by a modified Amagat method; a special electronic device was developed for the detection of the mercury level in the capillary tubing of the piezometer. Measurements were made on argon and nitrogen up to 1000°C and 1000 atm. The thermal conductivity was measured in an apparatus composed of 2 coaxial cylinders, separated by a very narrow space. An electronic device composed of a breaker amplifier and a magnetic amplifier was used for the temperature control. So far only measurements on nitrogen have been made. Some p, v, t data at very high pressure were obtained by the study, using very high-speed X-ray photography, of shockwaves generated in liquefied gases; the data obtained on supercritical argon extend to 72 000 atm and about 1000°C. A.

536.23 : 533.16 : 523.877

THERMAL CONDUCTIVITY IN THE HYDROGEN CONVECTION ZONE. See Abstr. 3660

536.244 : 533.6.011

3926. ON P.V.DVORNICHENKO'S PAPER "SOME CONSIDERATIONS REGARDING THE METHODS OF EVALUATING THE HEAT EXCHANGE AND HYDRAULIC RESISTANCE FOR A HIGH-VELOCITY GAS FLOW". A.A.Gukhman.
Zh. tekh. Fiz., Vol. 27, No. 4, 875-6 (1957). In Russian.

Points out four errors and inconsistencies committed by Dvornichenko (Abstr. 6101/1957). F.Lachman

536.252 : 538.3 : 532.5

3927. APPARATUS FOR STUDYING CONVECTION UNDER THE SIMULTANEOUS ACTION OF A MAGNETIC FIELD AND ROTATION.
Y.Nakagawa.
Rev. sci. Instrum., Vol. 28, No. 8, 603-9 (Aug., 1957).

An apparatus for the study of the instability of a layer of mercury heated from below and subjected to the simultaneous action of a magnetic field and rotation is described. The equipment is designed to examine the mode of convection and the dependence of the critical Rayleigh number ($=\alpha g \beta_C d^4/k\nu$, where g denotes the acceleration due to gravity, β_C the critical adverse temperature gradient, d the depth of the layer, k the thermometric conductivity, ν the kinematic viscosity, and α the coefficient of volume expansion) for the onset of instability on the values of non-dimensional parameters $Q_1 (=\sigma H^2 d^2/\pi^2 \rho \nu$, where H is the strength of the magnetic field, σ the electrical conductivity, and ρ the density of fluid) and $T_1 (=4\Omega^2 d^4/\pi^4 \nu^2$, where Ω denotes the angular velocity of rotation), the features proven to be essential in such studies. By using a reconditioned cyclotron magnet as a part of the experimental arrangement, this apparatus covers wide ranges of the parameters Q_1 (from 10 to 10^6) and T_1 (from 10^5 to 10^{10}). Typical results that can be obtained by this apparatus are discussed with a few illustrative examples. A.

536.253 : 518.5 : 621.317.79 : 681.142

3928. PRISMATIC FIN WITH NON-LINEAR HEAT LOSS ANALYSED BY RESISTANCE NETWORK AND ITERATIVE ANALOGUE COMPUTER. I.C.Hutcheon and D.B.Spalding.
Brit. J. appl. Phys., Vol. 9, No. 5, 185-91 (May, 1958).

An analysis is presented of the heat flow by natural convection from a fin of uniform conductivity and cross-sectional area, fixed at one end to a hot wall and immersed in a cooler fluid. A resistance network analogue is used in conjunction with a new type of iterative analogue computer to determine the temperature distributions and fin efficiencies for a variety of fin proportions, on the assumption that heat loss is proportional to the local temperature to the power 5/4. Results are compared with the case of linear heat loss. A.

536.33 : 535.231.4

3929. STUDY OF THE EFFECTIVE THERMAL EMITTANCE OF CYLINDRICAL CAVITIES. J.Vollmer.
J. Opt. Soc. Amer., Vol. 47, No. 10, 926-32 (Oct., 1957).

An equation is derived which relates the effective emittance of a cylindrical cavity to the emittance of the construction material, the ratio of the length to the radius of the cylinder, and the distance separating the cylinder and the receiver. This equation was checked by measuring the effective emittance of shallow cylinders of two different lengths, at four axial distances, and with three filter systems. The use of filters in combination with a construction material whose spectral emittance varies sharply is equivalent to varying the emittance of the construction material. In all cases considered, the experimental result and the value predicted are in agreement within the experimental limits. A.

536.33 : 535.231.5

BLACKBODY RADIATION AND THE RADIATION LAW CONSTANTS. See Abstr. 3840

536.4 : 537.323

THERMOELECTRIC COOLING. See Abstr. 3149

536.413 : 548.734

3930. X-RAY DETERMINATION OF THE THERMAL EXPANSION OF SINGLE CRYSTALS. V.V.Zubenko and M.M.Umanskii.
Kristallografiya, Vol. 2, No. 4, 508-13 (1957). In Russian.

Methods of controlling the temperature and of taking the X-ray photographs are described. The observed thermal expansions ($\times 10^6$ per deg C) are: Corundum: $\alpha_\perp = 5.6 \pm 0.1$; $\alpha_\parallel = 6.6 \pm 0.1$. $Li_2SO_4.H_2O$: $\alpha_C = 15.6 \pm 0.5$. Dipotassium tartrate: $\alpha_{33} = 31.5 \pm 1.0$. R.F.S.Hearmon

536.421.1 : 539.217

3931. MELTING AND DIFFUSION. J.W.Leech.
Nature (London), Vol. 181, 319-20 (Feb. 1, 1958).

Report of a symposium on "Melting, Diffusion and Related Topics" held at the National Research Council Laboratories, Ottawa on October 21-22, 1957. In contrast to a similar previous symposium (see Abstr. 1156/1956) this one is mainly about topics bearing on the melting process: pre-melting "anomalies"; relations between diffusion and melting parameters; radial distribution in liquids Ne, A, He; the grey–white tin transformation; the martensitic transformation in Li; viscosity of liquid He; the Lindemann melting formula. About 12 papers were read. An informal account of the proceedings is in preparation. R.O.Davies

536.421.1.07

3932. CALORIMETRIC ASSEMBLY FOR THE MEASUREMENT OF HEATS OF FUSION OF INORGANIC COMPOUNDS.
J.Goodkin, C.Solomons and G.J.Janz.
Rev. sci. Instrum., Vol. 29, No. 2, 105-8 (Feb., 1958).

The apparatus consists of a calorimeter of basically simple design, above which is a movable, vertical furnace for heating the specimen contained in a hermetically sealed platinum capsule. A complete series of measurements may thus be carried out on one sample. The capsule is dropped directly into a metal dry-chamber in the calorimeter in contact with a stirred liquid for measurement of heat content changes. A recommended procedure is described, based on experiments in pairs, one of each pair being a calibration drop, the other the specimen drop. The computation of heat content changes from the temperature changes observed is described. The limits of error of this and other calorimetric assemblies are critically discussed. Data are presented to illustrate the results for the LiCl–KCl eutectic mixture (m.p. 354.1°C) and the reproducibility of the measurements. The calorimetric assembly is capable of measurements of heats of fusion of inorganic compounds to an accuracy of ±2%. A.

536.421.4 : 532.77

3933. FREEZING POINTS OF LIQUIDS ADSORBED ON POROUS SOLIDS. B.R.Puri, D.D.Singh and Y.P.Myer.
Trans Faraday Soc., Vol. 53, Pt 4, 530-4 (April, 1957).

Freezing-point depressions of benzene, dioxane, p-xylene and ethylene diamine adsorbed on four different porous bodies at different relative vapour pressures corresponding to condensation in capillary pores of different radii were determined by measuring the equilibrium pressures of the systems at different temperatures. The values were found to agree fairly well with those calculated from thermodynamic considerations based on the theory of capillary condensation. The results indicate that the vapour pressure of the solid phase is not affected by capillary action, while that of the liquid phase is altered in accordance with the Kelvin equation. A.

536.423.1

3934. SOME ASPECTS OF SURFACE BOILING.
C.E.Faneuff, E.A.McLean and V.E.Scherrer.
J. appl. Phys., Vol. 29, No. 1, 80-4 (Jan., 1958).

An experiment is described in which the growth of vapour bubbles at a surface is followed in detail. Growth curves are obtained and shown to agree, within experimental error, with current theories of growth under idealized conditions, provided an average superheat present at the initiation of growth is used in the calculation. A criterion is proposed to permit an estimate of a delay time for vapour formation. The estimated delays are found to be in qualitative agreement with those measured. A.

536.423.15

3935. VAPOUR PRESSURE OF TRITIATED WATER. A.H.Price.
Nature (London), Vol. 181, 262 (Jan. 25, 1958).

The ratio of the vapour pressure of HTO to H_2O was determined over the range from 25.7° to 75.6°C, and was found to vary from 0.77 at the lower temperature to 0.89 at the liquid temperature. The molar heat of vaporization of tritiated water is found to be 10.9 kcal as compared with 10.3 kcal for ordinary water.

L.G.Carpenter

536.423.15 : 533.59

3936. A NEW METHOD OF MEASURING THE VAPOUR PRESSURE OF HEAVY LIQUIDS [HAVING A VERY LOW SPECIFIC VAPOUR PRESSURE]. J.Neuman.
Slaboproudý Obzor, Vol. 18, No. 7, 460-4 (1957). In Czech.

The instrument comprises a glass tube (which is connected to a diffusion pump), a light turbine consisting of 30 blades, a pan for the measured liquid, and heating and cooling systems. The turbine is suspended on a torsional filament in the glass tube slightly above the pan, and since its blades are inclined at 45° to the horizontal, it produces a deflection when the liquid in the pan is evaporating. The deflection is projected on to a scale by means of a mirror attached to the filament. The deflection α is proportional to the vapour pressure p of the measured liquid ($p = k\,\alpha$). Operation of the instrument is discussed in some detail and some experimental curves of pressure v. temperature are given (for Octoil–S, n-dibutylphthalate, chlophenoel, Octoil and a Soviet diffusion-pump oil). The device can be used at $p = 5 \times 10^{-7}$ to 10^{-4} mm Hg. R.S.Sidorowicz

536.423.15.07

3937. VAPOR PRESSURE APPARATUS. M.W.Cook.
Rev. sci. Instrum., Vol. 29, No. 5, 399-400 (May, 1958).

The apparatus has certain manipulative and accuracy advantages over the well-known isoteniscope. A reliable criterion for complete degassing is inherent in the apparatus. Since degassing is required only once for a series of determinations at various temperatures, the apparatus is well adapted where the amount of sample is limited. The useful temperature range of this apparatus is between the freezing point of mercury (−38.9°C) and the temperature at which the vapour pressure of mercury becomes appreciable (~ 0.1 mm at 80°C). The apparatus may not be used if the sample reacts chemically with mercury. A.

536.423.15.08 : 536.654

3938. THE MEASUREMENT OF VERY LOW VAPOUR PRESSURES USING RADIOACTIVE ISOTOPES. THE LATENT HEAT OF SUBLIMATION OF MERCURY DIPHENYL.
A.S.Carson, D.R.Stranks and B.R.Wilmshurst.
Proc. Roy. Soc. A, Vol. 244, 72-84 (Feb. 25, 1958).

A modified Knudsen effusion system, suitable for studying the vapour pressures of radioactive compounds, is described. The system has been used to measure the temperature variation of the vapour pressure of a sample of mercury diphenyl, labelled with the mercury isotope Hg^{203}. A figure of 26.95 kcal/mole is obtained for the latent heat of sublimation at 25°C. A.

536.424 : 539.32

A SECOND-ORDER PHASE TRANSFORMATION IN SODIUM NITRATE. See Abstr. 3509-10

536.424.1

3939. ON THE DETERMINATION OF THE TEMPERATURES OF RECRYSTALLIZATION OF METALS. V.L.Shmarts.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 1, 182-4 (1957).
In Russian.

By postulating that recrystallization begins at a temperature T_r such that $\int_0^{T_r} C\,dT = L$ (C = specific heat, L = latent heat of melting) the following formula is derived:

$$L = 3RT_r\left\{1 - \frac{3}{8}\frac{\Theta}{T_r} + \frac{1}{20}\left(\frac{\Theta}{T_r}\right)^2 - \frac{1}{1680}\left(\frac{\Theta}{T_r}\right)^4\right\}$$

(Θ = Debye temperature). This formula gives values of T_r for sixteen metals in much better agreement with experiment than that obtained from various empirical formulae. A.F.Brown

536.461

3940. INFLUENCE OF HYDROGEN AND DEUTERIUM ON FLAME VELOCITIES OF DRY CARBON MONOXIDE–OXYGEN MIXTURES. L.A.Watermeier.
J. chem. Phys., Vol. 27, No. 5, 1118-26 (Nov., 1957).

A constant pressure method employing a schlieren photographic technique was used to determine the space velocities of dry carbon monoxide–oxygen mixtures with added hydrogen and deuterium. Flame velocities were obtained by using the data together with theoretical expansion ratios. The results are presented and correlated with current diffusion and thermal theories. Neither theory explains the velocity ratios adequately although better agreement is found with the diffusion theory than with the thermal theory. The velocity ratios depended strongly upon H and D atom diffusion. A simple mechanism is proposed for the combustion processes in which it is postulated that $CO + O_2 + H_2$ flames are initiated by a hydrogen–oxygen reaction. A.

536.461 : 537.562

3941. MASS-SPECTROMETRIC OBSERVATIONS OF IONS IN FLAMES. P.F.Knewstubb and T.M.Sugden.
Nature (London), Vol. 181, 474-5 (Feb. 15, 1958).

A sampling technique was developed which detects down to 10^7 ions per cm^3. Hydrogen/air flames show H_3O^+ and H_2O^+. With added alkalis, in addition to the simple ions (Na^+, etc.) hydrated ions with one, two and possibly three attached H_2O occur. With strontium, Sr^+ and $SrOH^+$ and hydrates of these occur; Ca and Ba behave similarly. The reaction zone of acetylene/air shows almost every mass number up to 100; above the reaction zone, peaks correspond to those of the H_2 flame, with additions at mass 30 and 48, due to either CH_2O^+ or NO^+, and its hydrate. A.G.Gaydon

536.461 : 537.562

3942. ION IDENTIFICATION IN FLAMES BY MASS SPECTROMETRY. J.Deckers and A.Van Tiggelen.
Nature (London), Vol. 181, 1460 (May 24, 1958).

Using an acetylene/oxygen/nitrogen flame, a strong mass peak at 19 is attributed to H_3O^+. Weaker peaks at 18, 28 and 30 are due to H_2O^+, CO^+ and NO^+. Results are checked using partially deuterated acetylene. This modifies a previous interpretation. A hydrogen/nitrous oxide/nitrogen flame shows only a weak peak due to NO^+. A.G.Gaydon

536.461 : 535.333

OH SPECTRA AND FREE-ATOM CONCENTRATIONS IN HYDROGEN FLAMES. See Abstr. 3853

536.48 : 532.13

3943. THE VISCOSITY OF LIQUID HELIUM BETWEEN 0.78°K AND 1.1°K. A.D.B.Woods and A.C.H.Hallett.
Canad. J. Phys., Vol. 36, No. 2, 253-4 (Feb., 1958).

This was measured by a rotating cylinder viscometer similar to one previously used at higher temperatures (Abstr. 8702/1955). The results agree at least qualitatively with the predictions of the Landau–Khalatnikov theory, both above 1° and at 0.8°K. (The range between 0.8° and 1.0°K is not covered by this theory). The value 140 ± 30 μP at 0.78°K compares favourably with Khalatnikov's 173 at 0.8°K (Abstr. 2132/1957). H.London

536.48

3944. VISCOSITY OF LIQUID HELIUM II NEAR THE LAMBDA POINT. J.G.Dash.
Phil. Mag. (Eighth Ser.), Vol. 3, 586-90 (June, 1958).

The theory of Landau and Khalatnikov for the viscosity of liquid He II is examined in the neighbourhood of the lambda-point.

Arguments are advanced against the validity of the ideal gas approximation for rotons, and a qualitative roton liquid model is proposed. The temperature dependence of viscosity of the liquid model is found to correspond to the observed viscosity above 1.8°K, and with the discontinuity in the temperature derivative of viscosity at the lambda-point. A.

536.48

3945. RIPPLONS AND THE CRITICAL VELOCITY OF THE HELIUM FILM. K.R.Atkins.
Physica, Vol. 23, No. 12, 1143-4 (Dec., 1957).

Kuper (Abstr. 9138/1957) has suggested that the critical velocity of the film is due to the excitation of quantized surface waves (ripplons). This treatment was based on gravity-controlled surface waves of wavelength $\lambda \ll$ depth d. The present paper considers a wave controlled mainly by Van der Waals' forces, and $\lambda \gg d$. This gives $V_{crit} = (3\alpha/d^5)^{1/2}$, where α is a measure of the Van der Waals' force, which relates d to the height H above the bulk liquid according to $\alpha/d^3 \sim gH$. Thus $V_{crit} \sim (3gH) \sim 50$ cm/sec for $H \sim 1$. Although this is of the right order of magnitude, the decrease of dV_{crit} with increasing d is regarded as unsatisfactory. H.London

536.48

3946. PERIODIC BOUNDARY LAYER EXPERIMENTS IN LIQUID HELIUM. R.J.Donnelly and A.C.H.Hallett.
Ann. Phys. (New York), Vol. 3, 320-45 (March, 1958).

A hydrodynamical study of oscillation experiments in helium I and helium II is made using the concept of the boundary layer. Experimental results show that the hydrodynamical flow of helium II changes with amplitude of oscillation. At low amplitudes the simple two-fluid model is applicable; at higher amplitudes the normal and superfluid components are in common motion and at the highest amplitudes the flow is turbulent. A table of values of the kinematic viscosity of helium II for the condition when the two fluids move together is given. The principle of dynamical similarity is discussed and a dimensionless similarity parameter is given which governs the onset of turbulence in liquid helium. In helium II a new similarity parameter is required at lower amplitudes. An empirical expression is given for this parameter. Some new theoretical questions are raised. A.

536.48

3947. SUPERCONDUCTIVITY OF THORIUM BELOW 1°K. N.M.Wolcott and R.A.Hein.
Phil. Mag. (Eighth Ser.), Vol. 3, 591-6 (June, 1958).

The critical magnetic field of thorium was determined between 0.1°K and 1.37°K, the transition temperature, where the initial slope of the critical field curve is 190 gauss/deg. The data indicate a value of 162 gauss for the critical field at absolute zero. The critical-field curve departs from a parabola near the transition temperature. The electronic specific heat, 11.1×10^{-4} T cal mole^{-1} deg^{-1}, deduced from the magnetic measurements, is in substantial agreement with the previously determined calorimetric value. A.

536.512

3948. A SCALE FOR SOLID-STEM THERMOMETERS. E.Greil.
J. sci. Instrum., Vol. 35, No. 1, 35-6 (Jan., 1958).

Both the English and the German styles of scale periodically obscure the meniscus. The style suggested and illustrated has the advantages that the mercury column is not covered by graduation lines or figures along the full length of the scale, and the units of the figures remain in the field of vision, i.e. close to the column S.Weifftroub

536.521

3949. A PHOTOELECTRIC PYROMETER FOR THE MEASUREMENT OF THE COLOUR TEMPERATURE OF FLAMES. N.N.Sobolev and F.S.Faizullov.
Optika i Spektrosk, Vol. 3, No. 2, 162-8 (1957). In Russian.

Light from the source whose temperature is required passes through a filter on to a photoelectric detector; the ratio of the respective outputs from two filters (usually red and blue) is a simple function of temperature, and the instrument can be calibrated by a standard source. In one instrument the ratio is obtained by alternate placing of the filters in the beam; in the other the light path is divided so that both filters are used simultaneously. L.Bovey

536.53 : 537.312.6 : 621.317.79

3950. A HIGH STABILITY MAINS-OPERATED RECORDING THERMISTOR THERMOMETER. A.W.Melville.
J. sci. Instrum., Vol. 35, No. 5, 179-80 (May, 1958).

A simple recording thermometer is described which is mains operated, has a total variation at less than 1% for a mains variation of 10%, and a warm-up time of less than 5 min. With the given constants full-scale deflection corresponds to 10°F. Any suitable 1 mA recorder may be used. A.

536.532

3951. THE PERFORMANCE OF THERMALLY INERT METAL BLOCKS AS COLD JUNCTION ENCLOSURES FOR THERMOCOUPLES K.L.Morphew.
Elect. Energy, Vol. 2, No. 5, 172-4 (May, 1958).

The requirements of a high stability thermocouple cold junction for use in the accurate measurement of small temperature changes are examined. The suitability of different materials is then discussed, and a description is given of two sets of experiments in which the thermal behaviour of two large thermally insulated cylinders was observed. Some typical results are given and it is shown that the apparatus provides a reliable temperature datum having a temperature drift of much less than 10^{-3} deg C/min. A.

536.55 : 534.222.2

3952. TEMPERATURE MEASUREMENTS OF SHOCK WAVES BY THE SPECTRUM-LINE REVERSAL METHOD. J.G.Clouston, A.G.Gaydon and I.I.Glass.
Nature (London), Vol. 181, 1325-6 (May 10, 1958).

The sodium-line reversal method has been adapted, using a photomultiplier and c.r.o. responsive only to transient signals, to give time-resolved records of temperature behind shock fronts in air, O_2 and N_2. Temperatures can be determined to within ± 30° in the range 2000-2900°K and generally agree with theoretical values. With H_2 as driver gas, O_2 and air burn at the interface, giving a marked temperature rise in this region. Shock speeds were measured with gold temperature-sensitive elements, since ionization probes were found unsatisfactory. A.G.Gaydon

536.62

3953. DATA ON THE TRANSITORY CURVE OBTAINED WITH A MICROCALORIMETER. D.Blet-Talbot and G.Blet.
C.R. Acad. Sci. (Paris), Vol. 246, No. 4, 567-70 (Jan. 27, 1958). In French.

The curve of temperature as a function of time between the instant of application of a constant heat flux to the lower surface of a calorimeter and the attainment of equilibrium is generally represented by an exponential function. A more accurate form is derived theoretically, and the results are given of an experimental verification for the case of a cylindrical calorimeter with the flux through the lower surface and thermocouples attached to the upper surface. Thermal leakage can occur from both surfaces and from the thermocouples, but not from the curved surface. S.Weintroub

536.62

3954. ROCKING-BOMB CALORIMETER FOR MEASURING HEATS OF SOLUTION. S.R.Gunn.
Rev. sci. Instrum., Vol. 29, No. 5, 377-80 (May, 1958).

A calorimeter designed for measuring the heats of rapid reactions, such as dissolution and hydrolysis near room temperature, is described. The instrument consists of a sealed copper bomb suspended in an evacuated submarine immersed in a thermostat; stirring is accomplished by rocking the assembly through an arc of 150°. Measurements were made of the heat of solution of potassium chloride in water at 25.00°C. A.

536.627

3955. AN ADIABATIC CALORIMETER FOR THE RANGE 30° TO 500°C. E.D.West and D.C.Ginnings.
J. Res. Nat. Bur. Stand., Vol. 60, No. 4, 309-16 (April, 1958).

An adiabatic calorimeter accurate to 0.1% and suitable for heat capacity measurements of solids and liquids over the temperature range 30° to 500°C is described. Factors affecting the design and accuracy are discussed. Automatic controls permit one-man operation of the apparatus. Measurements of the heat capacity of Al_2O_3 agree to 0.1% with earlier measurements made with other calorimeters at the National Bureau of Standards. A.

536.631

3956. CALORIMETRIC INVESTIGATIONS RELATING TO THE TRANSFORMATION IN $NaNO_3$ AND ITS MELTING PROCESS. A.Mustajoki.
Ann. Acad. Sci. Fennicae A VI, Paper 5, 17 pp. (1957). In German.

Using a slightly improved form of the author's apparatus (Abstr. 258/1952) the specific heat at constant pressure was measured for both heating and cooling over the temperature range from 60° to 340°C. The results are tabulated and shown graphically, indicating clearly the variations in the neighbourhoods of the trans-

formation point(about 270°C) and the melting point (306.2°C). The transformation is considered to be a λ-transformation. Calculated values for the molecular heat, enthalpy and entropy are also tabulated. The heats of transformation and fusion are 944.0 and 3490 cal/mol, and their entropies 1.26 and 0.03 cal/mol. deg., respectively. S.Weintroub

536.631

3957. THE SPECIFIC HEAT [C_p] OF CAESIUM NITRATE IN THE TEMPERATURE RANGE FROM 50° TO 450°C TOGETHER WITH ITS HEATS OF TRANSFORMATION AND FUSION. A.Mustajoki.
Ann. Acad. Sci. Fennicae A VI, Paper 7, 12 pp. (1957). In German.

See previous abstract. The same apparatus was used to determine c_p for $CsNO_3$ for both heating and cooling. The results are tabulated and shown graphically. The specific heat rises linearly with temperature except in the neighbourhoods of the transformation point (151.5°C) and the melting point (405.5°C), where there are anomalous increases. The heats of transformation and fusion were 0.893 ± 0.06 and 3.37 ± 0.03 kcal/mol, and the corresponding entropies 2.10 ± 0.02 and 4.97 ± 0.04 cal/mol. deg., respectively. S.Weintroub

536.631

3958. HEAT CAPACITIES OF CrF_3 AND $CrCl_3$ FROM 15 TO 300° K. W.N.Hansen and M.Griffel.
J. chem. Phys., Vol. 28, No. 5, 902-7 (May, 1958).

The heat capacities were measured. CrF_3 has two peaks; the upper peak has its maximum at 69.8° K and is associated with a known magnetic transition. The lower peak has its maximum at 45.6° K and had not been correlated with magnetic phenomena. The total magnetic entropy is divided almost equally between the two. $CrCl_3$ has a single peak at 16.8° K which is associated with a ferromagnetic transition. For CrF_3, $S^0_{298.15} = 22.44$ e.u.; for $CrCl_3$, $S^0_{298.15} = 29.38$ e.u. Other thermodynamic functions are tabulated. A.

536.633 : 534.221

SPECIFIC HEATS OF OXYGEN. See Abstr. 3808

THERMODYNAMICS

536.71

3959. PRESSURE–VOLUME RELATIONS IN SOLIDS. G.E.Duvall.
Amer. J. Phys., Vol. 26, No. 4, 235-8 (April, 1958).

An equation of state of the form $P(V) = f(V) + Tg(V)$, which is useful for condensed matter, is proposed for the illustration of thermodynamic principles. Pressure–volume relations for adiabatic and shock compressions are derived with the assumption that the specific heat at constant volume is independent of temperature. These derived relations are illustrated for a "Murnaghan" equation of state, and constants of this equation for several metals are tabulated. A.

536.71 : 536.23

EQUATION OF STATE OF GASES AT HIGH PRESSURES AND ELEVATED TEMPERATURES. See Abstr. 3925

536.752

3960. NOTE ON A PROBLEM CONCERNING THE GIBBS PARADOX. M.J.Klein.
Amer. J. Phys., Vol. 26, No. 2, 80-1 (Feb., 1958).

An ideal gas A is allowed to mix with an ideal gas B whose atoms are all A atoms in an excited metastable state. It is shown that after a time long compared with the lifetime of the metastable state there is an entropy increase larger than the mixing entropy, which "disappears". A.

536.782

3961. NEW MEASUREMENTS OF THE JOULE–THOMSON EFFECT OF HYDROGEN. W.Koeppe and F.X.Eder.
Exper. Tech. der Phys., Vol. 4, No. 1, 26-8 (1956). In German.

The principal details of a hydrogen liquefier are described, and measurements are reported for pre-expansion temperatures from 45° to 80° K and pressures up to 120 atm. Curves are given for ΔT as a function of pressure for eight temperatures, and from them are derived detailed diagrams of enthalpy and entropy v. temperature behaviour. The results are found to disagree with those of most of the workers to whom references are given. P.Gray

536.791 : 539.2

3962. GRÜNEISEN'S LAW AND THE THIRD LAW OF THERMODYNAMICS. M.J.Klein and S.J.Glass.
Phil. Mag. (Eighth Ser.), Vol. 3, 538-9 (May, 1958).

For a solid satisfying Grüneisen's equation of state the relation

$$\left(\frac{\partial S}{\partial V}\right)_T = \frac{\beta}{K} = \frac{\gamma C_V}{V}$$

holds, therefore this is a system which has the property that if $C_V \to 0$ as $T \to 0$, then the Nernst heat theorem is satisfied. P.T.Landsberg

ELECTRICITY

537.081 : 538.3.081

3963. THE RATIONALIZATION IN ELECTROMAGNETISM AND ELECTROSTATICS. F.Dahlgren.
K. Tekn. Högsk. Handl., No. 109, 14 pp. (1957).

The physical meaning of the rationalization of the electric and magnetic quantities and units is treated in such a manner that most complications are avoided. The result is illustrated in a table and a diagram. Both showing that the rationalization refers to a change of definition of quantities, the units being unaltered. A.

ELECTROSTATICS. DIELECTRICS

537.21 : 371.3

3964. NEW APPROACH TO THE TEACHING OF ELECTROSTATICS IN GENERAL PHYSICS COURSES. J.Rekveld.
Amer. J. Phys., Vol. 26, No. 3, 139-43 (March, 1958).

The necessity of adapting teaching methods to the rationalized m.k.s. system of units is briefly discussed, and a short analysis given of the objections to the use of Coulomb's law as a basic, introductory law. A new approach is suggested, which introduces Gauss' law by means of Faraday's ice-pail experiment. A.

537.221 : 537.533.2

3965. COMMENTS ON THE PAPER BY J.C.RIVIÈRE: "CONTACT POTENTIAL DIFFERENCE MEASUREMENTS BY THE KELVIN METHOD". H.E.Farnsworth.
Proc. Phys. Soc., Vol. 71, Pt 4, 703-4 (April, 1958).

Recent measurements of contact potentials by Rivière (Abstr. 7078/1957) employed metal films produced by condensation from vapour. The present paper offers experimental evidence that such films have work functions which, presumably owing to a high density of lattice defects, are lower than those of the bulk metals, and which can be raised to those values by annealing. The work function depends also on the material used as a base for the film. This effect is probably due to different preferred orientations of the small crystallites. P.M.Davidson

537.221

3966. THE ELECTRICITY OBSERVED AFTER CONTACT BETWEEN TWO BODIES. M.M.Bredov and I.Z.Kshemyanskaya.
Zh. tekh. Fiz., Vol. 27, No. 5, 921-8 (1957). In Russian.

Measurements are reported of the charge observed on separating two surfaces in contact. The charge increases rapidly with speed of separation. In the case of two metals in contact, the measured charge is proportional to the difference between the work functions of the surfaces. In the case of contact of a metal with a semiconductor, the charge depends also on the free-carrier concentration in the semiconductor and on its dielectric constant. J.B.Arthur

537.221

3967. EXPERIMENTS ON THE ELECTROSTATIC CHARGING OF CO_2 SNOW. A.Tietze.
Z. Naturforsch., Vol. 12a, No. 1, 82 (Jan., 1958). In German.

537.222

3968. ELECTRIFICATION OF AEROSOLS BY IONIC DIFFUSION. R.Gunn.
Amer. J. Phys., Vol. 25, No. 8, 542-6 (Nov., 1957).

The distribution of free electrical charges transferred to cloud droplets by ionic diffusion provides an example of a simple statistical process. Tables are constructed from first principles, shown to agree with successive terms of the binomial point equation of statistics, and applied to the initial stages of droplet electrification. The final equilibrium distribution, described by the basic electrification equation for aerosols, corresponds to an equipartition between the electrostatic energy of the droplets and their thermal kinetic energy. A.

537.226.1

3969. DIELECTRIC PROPERTIES OF IODINE IN AROMATIC SOLVENTS AT 9000 Mc/sec. G.W.Nederbragt and J.Pelle.
Molecular Phys., Vol. 1, No.1, 97-8 (Jan., 1958).

The complex dielectric constants of solutions of iodine in benzene, p-xylene and 1.3.5-trimethylbenzene were determined in a resonant cavity. Relaxation processes produce a decrease in dielectric constant, which is most marked near the relaxation frequency. The measurements indicate that in mesitylene there is an effective relaxation time of 4×10^{-12} sec, and in the other solvents it is much shorter. J.M.Baker

537.226.1.08 : 539.19

3970. RANGE OF VALIDITY OF HIGASHI'S EQUATION FOR A QUICK DETERMINATION OF DIPOLE MOMENT IN SOLUTION. B.Krishna and K.K.Srivastava.
J. chem. Phys., Vol. 27, No. 4, 835-7 (Oct., 1957).

Mathematical analysis shows that Higashi's equation is valid for the straight part of the curve showing the variation of the dielectric constant of the solution with the mole fraction of the solute. With the six organic solutes examined the above conclusion is found to be valid for four namely, chlorobenzene, ortho-dichlorobenzene, nitrobenzene, and methylene chloride. Ethylene dichloride and ethylene dibromide whose molecules are subject to restricted rotation, show anomalous results. It is likely that Higashi's equation may not be applicable to such molecules. Benzene was used as a solvent throughout. A.

537.226.1.08 : 621.317.735

3971. WIDE-BAND HIGH-PRESSURE DIELECTRIC CELL. M.G.Vallauri and P.W.Forsbergh, Jr.
Rev. sci. Instrum., Vol. 28, No. 3, 198-9 (March, 1957).

A quartz and metal seal capable of holding compressed gases at 1500 atm forms the tapered, coaxial transition leading from a standing-wave detector or from a bridge, into a coaxial condenser. The continuity of characteristic impedance through the seal is sufficiently good to allow accurate measurement of dielectric constant and loss in compressed gases and liquids from low frequencies to 3000 Mc/s (λ_0 = 10 cm) in a single cell. The performance is illustrated with isotherms of the dielectric constant of N_2O through the critical point. Organic sealing materials are not used. The unit promises to be satisfactory for a wider temperature range than is reported here. A.

537.226.2

3972. MICROWAVE DISPERSION AND HYDROGEN BONDING IN SEVERAL ALCOHOLS. P.C.Brot.
Ann. Phys. (Paris), Sér. 13, Vol. 2, No. 9-10, 714-63 (Sept.-Oct., 1957). In French.

A description is given of measurements at 9, 3 and 1 cm and between −100° and +100°C of dispersion in liquid alcohols from 1-hexanol-n to 1-dodecanol-n, and their interpretation discussed in terms of H-bond polymerization. Three regions of dispersion are distinguished: the ordinary Debye region; a second region ascribed to the breaking of H-bonds and subsequent re-orientation of the dipoles; and a third region at the highest frequencies, which is ascribed to monomers and to molecules at the end of polymer chains. The latter conclusion is supported by studies of dilute solutions. A value of 6 kcal/mole for the H-bond energy is deduced from study of the degree of polymerization and of the kinetics of the process. J.Hawgood

537.226.2 : 537.311 : 538.221

3973. THE DIELECTRIC BEHAVIOUR OF MAGNESIUM MANGANESE FERRITE. J.Peters and K.J.Standley.
Proc. Phys. Soc., Vol. 71, Pt 1, 131-3 (Jan., 1958).

The permittivity and a.c. resistivity were measured over the frequency range from 30 c/s to 100 Mc/s and at temperatures between 20° and 220°C. At 20°C the permittivity is relatively constant, while the resistivity falls rapidly with frequency; at 200°C the converse is true. These results do not fit Koops' model (Abstr. 6964/1951) of an inhomogeneous dielectric, and it is suggested that a relaxation of permanent dipoles is taking place. K.W.Plessner

537.226.2 : 541.127

DIELECTRIC DISPERSION OF BORIC ACID IN WATER. THE RATE OF RECOMBINATION OF H^+ AND $H_2BO_3^-$. · See Abstr. 3536

537.226.2

3974. DIELECTRIC PROPERTIES OF LEAD TITANATE AND ITS SOLID SOLUTIONS AT LOW TEMPERATURE UNDER STRONG ELECTRIC FIELD. S.Nomura and J.Kobayashi.
J. Phys. Soc. Japan, Vol. 13, No. 1, 114-15 (Jan., 1958).

Polarization/field loops were obtained at 50 c/s for ceramic specimens. By plotting maximum polarization against temperature, a phase transition in the range −30 to −80°C became apparent which had been barely detectable on permittivity/temperature plots. There was a strong field dependence of the transition temperature, extrapolation to zero field giving a value of −30°C for $PbTiO_3$ and lower temperatures for $PbTiO_3$/$PbSnO_3$ mixtures. K.W.Plessner

537.226.3.08 : 621.317.374

3975. CALORIMETRIC MEASUREMENT OF TAN δ IN THE METRE WAVELENGTH RANGE. W.Holzmüller and J.H.Grohe.
Exper. Tech. der Phys., Vol. 5, No. 2, 49-58 (1957). In German.

Precision measurements of loss factors of the order 10^{-5} were made on slabs of test materials inserted between circular condenser plates mounted axially at the centre of a cylindrical cavity resonator in a temperature-controlled cabinet. Adjustments were provided for varying the plate separation and the tuning of the two halves of the resonator. Calibrated frequencies ω in the decimetre and metre ranges at a measured voltage U were applied inductively to the condenser (of capacity C), and the temperature rise due to the absorption heat was measured on a Cu—constantan couple. Standardization was carried out using a slab of semiconductor material in place of the test material and measuring the current flow I from a known voltage source V. Then $\tan\delta = IV/U^2C\omega$. A linear temperature characteristic of loss angle is shown for Polystyrol, Polyamid Leuna and Plexiglass. The loss factor for Polyamid Leuna also showed voltage dependence. W.J.Mitchell

537.226.31

3976. DIELECTRIC LOSSES IN TiO_2 SINGLE CRYSTALS. J.van Keymeulen.
Naturwissenschaften, Vol. 45, No. 3, 56 (1958).

Maxima in the tan δ v. frequency curves were found in crystals doped with iron or irradiated with neutrons, but not in the pure or oxygen-deficient crystals. The measurements, made over a range of temperatures, are interpreted in terms of a dipole relaxation, the dipoles being formed by associated defects in the crystal structure. K.W.Plessner

537.226.32

3977. INFLUENCE OF EXTERNAL TREATMENTS ON ELECTRET BEHAVIOR. J.W.Wild and J.D.Stranathan.
J. chem. Phys., Vol. 27, No. 5, 1055-9 (Nov., 1957).

The following effects have been observed. (1) When the surface of an electret which exhibited a homocharge was planed in a lathe, the sign of the equivalent surface charge changed to that of the heterocharge. This heterocharge then decayed and the homocharge finally became dominant again. The magnitude of the final homocharge was smaller than that of a control electret which was not planed. (2) Repeated planing of an electret, with time allowed for recovery between successive planings, resulted in repetition of the cycle described in (1). (3) Wax dummies (not subjected to an electric field during manufacture) which were given a frictional charge and then planed, showed no reversal of sign; they did exhibit a small recovery after being planed. (4) Electrets subjected to 100% relative humidity exhibited an abrupt decrease in equivalent surface charge. Removal of the moisture resulted in a gradual slight recovery. (5) The curve relating the equivalent surface charge and the logarithm of the pressure of the air surrounding an electret has the same form as the curve of the sparking potential for air versus the logarithm of the pressure. Thus, all the treatments described resulted in a decay of the homocharge, followed by a partial recovery upon removal of the disturbing influence. The observed behaviour can be explained in terms of the electret mechanism proposed by Gross. A.

537.226.33

3978. DIELECTRIC LOSS IN INSULATING SOLIDS CAUSED BY IMPURITIES AND COLOUR CENTRES. J.Volger.
Disc. Faraday Soc., No. 23, 63-71 (1957).

Experiments at low temperatures on solids with various lattice defects have revealed the existence of dielectric relaxation phenomena due to these defects. The relaxation times are governed by activation energies far smaller than those normally found with diffusion or migration of ions. Typical measurements are given and discussed qualitatively in relation to models of some lattice imperfections including colour centres. A.

537.228.1

3979. SOME PIEZOELECTRIC PROPERTIES OF POLYCRYSTALLINE SOLID SOLUTIONS OF $(Ba,Sr)TiO_3$, $Ba(Ti,Sn)O_3$ AND $Ba(Ti,Zr)O_3$. V.A.Bokov.
Akust. Zh., Vol. 3, No. 2, 104-8 (1957). In Russian.

The variation of the properties is studied with respect to

polarizing field intensity and temperature. With increasing polarizing field the $|d_{31}|$ piezo-modulus is found to pas through a maximum. This is explained by a reorientation of domains. With the polarizing field applied to the tetragonal phase, the $|d_{31}|$ decreases with rise of temperature, and there is no maximum at the Curie point.

C.R.S.Manders

537.228.1 : 548.0

PIEZOELECTRIC PROPERTIES OF CRYSTALS. See Abstr. 3552

537.27

3980. NUMERICAL CALCULATION OF CERTAIN SMALL ELECTROSTATIC EFFECTS. R.Cade and K.A.Small.
J. appl. Phys., Vol. 29, No. 1, 53-5 (Jan., 1958).

A numerical method is described which enables the effect of thin wires upon a given electrostatic field to be calculated, in the case when the wires are straight and of uniform circular cross-section. A brief description is given of a problem to which the method was applied, and of the results obtained. A.

ELECTRIC CONDUCTION. CURRENTS

537.311.081.3 : 621.317.331

3981. AN ABSOLUTE DETERMINATION OF RESISTANCE. M.Romanowski and N.Olson.
Canad. J. Phys., Vol. 35, No. 11, 1312-42 (Nov., 1957).

An absolute determination of resistance was made in the laboratories of the National Research Council, using a bridge which was originally derived as a modification of Campbell's network. It can be shown that this network can also be treated as a special case of the bridge used by Hartshorn for the comparison of equal mutual inductors. This latter aspect is a very valuable feature, for it means that the same basic network can be used for nearly all the a.c. operations, i.e. calibration of inductors in terms of the computed standard, measurement of self-capacitances and intercapacitances, and the inductance bridge. The change from the comparison bridge to inductance bridge is accomplished simply by replacing one of the inductors by one having twice its value and by shunting its primary by an appropriate resistor. By doing so, the very low value of the "potentiometer" in the comparison bridge increases so as to be equal to $R_1 = 1$ ohm, the latter becoming the resistor whose value is to be determined in terms of inductance (length) and frequency (time). The computed value of the standard inductor being equal to 10 mH nominal, the value 20 mH is obtained by the addition method on a specially designed inductor. A complete analysis of the circuit, including all small terms (self-capacitances, intercapacitances, residual inductances), is made for all operations: comparisons of inductors, addition of inductances, and finally the main bridge. The methods for the evaluation of these small terms are the most important and are therefore given with some detail. This includes also the evaluation of a ratio of resistances that figures in the equation for R_1. This is made by means of a resistance comparator and its auxiliary equipment. A complete measurement is quoted from the laboratory book. A total over 100 such measurements of R_1 in absolute units was made. Their average shows that the unit presently used in the N.R.C. laboratory (deduced from calibrations made on N.R.C. standards by other national laboratories) is about 8 parts in a million smaller than the unit given by this method. This absolute unit agrees very closely with units resulting from similar work done in various other national laboratories. A.

537.311.1

3982. ELECTRICAL CONDUCTIVITY AND THERMAL FLUCTUATIONS. R.E.Burgess.
Physica, Vol. 23, No. 8, 705-6 (Aug., 1957).

Criticism of a theory of electrical conductivity of solids by Meltzer (see Abstr. 8597/1957), which was based on consideration of electrical charge fluctuations. A discrepancy of a factor of $\frac{1}{2}$ from the values of conductivity given by the Lorentz—Sommerfeld theory is traced to neglect of the fluctuations of free path for each velocity class of charge carrier. B.Meltzer

537.311.3 : 539.234 : 541.183.2

3983. THE STRUCTURE OF EVAPORATED BARIUM FILMS. Y.Mizushima, Z.Oda and O.Ochi.
J. Phys. Soc. Japan, Vol. 12, No. 4, 355-68 (April, 1957).

The electrical resistance and nitrogen sorption at liquid-oxygen temperature were measured for barium films evaporated and heat-treated under various conditions. The conditions which controlled the properties of the film were: temperature of substrate during deposition; temperature of substrate at annealing; pressure of residual gas during deposition. Comparing the temperature variation of electrical resistance with sorption property for nitrogen, the following conclusions were reached: (1) granular structure plays an important role in resistance, as well as in nitrogen sorption; (2) the contribution of the imperfections included in each crystalline lattice is also remarkable at low temperature, but decays easily at higher temperatures. The mechanism of nitrogen sorption on barium films is also discussed. A.

537.311.31 : 539.219

3984. THE THEORY OF THE RESIDUAL ELECTRICAL RESISTIVITY OF INTERSTITIAL ALLOYS.
A.A.Smirnov and I.A.Stoyanov.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 2, 228-31 (1957).
In Russian.

On a one-electron model the residual resistivity of alloys is calculated as a function of composition, long-range order parameters and "correlation" parameters (i.e. parameters measuring the degree of occupation of lattice sites and interstitial positions by atoms of various kinds). A.F.Brown

537.311.31

3985. RESIDUAL ELECTRICAL RESISTIVITY OF BINARY SYSTEMS OF METALLIC ALLOYS. N.V.Grum-Grzhimailo.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 1, 23-9 (1957).
In Russian.

A re-examination of the Nordheim theory of resistivity of alloys (1931). Measurements were made of the residual electrical resistivity (ρ) and the temperature coefficient of resistance for the whole range of composition (c) of the following alloy systems: Cu-Au, Au-Ag, Ni-Cu, Mg-Cd, Ni-Co and Fe-Cr. About 24 compositions were measured in each system. The results are given in graphs which show that the parabolic ρ/c relation predicted (and shown experimentally) by Nordheim is a very poor approximation to the experimental points. Moreover, the temperature coefficient of resistance is far from independent of c. It appears that the agreement with theory claimed by Nordheim and others was fortuitous, being due to a lucky choice of system (Au-Ag) and of composition within the chosen system. A.F.Brown

537.311.31

3986. SOME PECULIARITIES IN THE ELECTRICAL RESISTIVITIES OF NICKEL-CHROMIUM ALLOYS.
S.D.Gertsriken and A.V.Progrushchenko.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 3, 505-10 (1957).
In Russian.

The electrical resistivities (ρ) of Ni_3Cr and of Ni_3Cr + 7% Mo were measured before and after various thermal and mechanical treatments. Results were: The position of the maximum in the ρ/T curve moved towards higher T (temperature) values as a result of prolonged heating above 500° C. Rolling lowered ρ by up to 12%; ρ was increased by heating at about 500° C; the activation energy for this process was found, and agrees with the results of Nordheim and Grant (J. Inst. Metals, Vol. 82, 440, 1954). Prolonged heating at 1200° C lowered ρ. Analysis of the ρ/T curves failed to confirm the existence of an order-disorder transition at 544° C as was reported by Taylor and Hinton (J. Inst. Metals, Vol. 81, 169, 1952-3). A.F.Brown

537.311.31 : 538.632 : 537.323

3987. NOTE ON SOME PROPERTIES OF GAMMA BRASS.
T.Sato and S.Noguchi.
J. Phys. Soc. Japan, Vol. 12, No. 4, 335-8 (April, 1957).

The electrical resistance and magnetoresistance were measured at liquid helium, liquid nitrogen and room temperature, and the Hall coefficient and thermoelectric power at room temperature. Data of the electrical resistance are presented for several samples having various concentrations. In the relation between specific resistivity and concentration, a minimum occurs at about 34% by weight of copper. The value of the Hall coefficient and of the thermoelectric power are comparable to the values of pure metals. The mangeto-resistance is small at room temperature, but becomes large at liquid helium temperature. Differences in the physical properties between gamma brass and bismuth are discussed. A.

537.311.31 : 538.632

3988. MAGNETOELECTRIC PROPERTIES OF THIN NICKEL FILMS MAGNETIZED TO SATURATION. T.Rappeneau.
C.R. Acad. Sci. (Paris), Vol. 246, No. 4, 571-4 (Jan. 27, 1958).
In French.

The magnetoresistance of evaporated nickel films 370 to 690 A

thick, was measured. Magnetic fields between 4×10^3 and 8×10^3 Oe were applied in the plane of the film at various angles to the current direction. The results are compared with those for solid nickel.
D.J.Oliver

537.311.31

3989. ON THE PROBLEM OF THE ANISOTROPY OF ELECTRICAL CONDUCTIVITY IN FERROMAGNETICS.
K.P.Rodionov and V.G.Shavrov.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 3, 385-91 (1957).
In Russian.

The electrical conductivities corresponding to the longitudinal and transverse effective masses of current carriers in a ferromagnetic are calculated. The calculation is based on the s–d exchange model, and account is taken of spin–spin interaction between s and d electrons. 12 references. A.F.Brown

537.311.31 : 538.22

ELECTRICAL RESISTIVITY OF SOME TRANSITION METAL SILICIDES. See Abstr. 3228

537.311.32 : 537.226.33

3990. DIELECTRIC RELAXATION AND THE ELECTRICAL CONDUCTIVITY OF ICE CRYSTALS.
H.Gränicher, C.Jaccard, P.Scherrer and A.Steinemann.
Disc. Faraday Soc., No. 23, 50-62 (1957).

The results of previous and recent extended dielectric investigations on pure hexagonal ice crystals and on mixed-crystals containing hydrofluoric acid are summarized. Measurements of the d.c. conductivity were performed using electrodes of different nature. Quantitative electrolysis experiments demonstrate the ionic character of the electrical conductivity. The theory of the dynamic behaviour of dielectrics is applied to ice assuming that polarization changes only occur at lattice imperfections of two types: orientational defects (i.e. vacant and double occupied hydrogen bonds) and ionized states (i.e. H_3O^+ and OH^-). For both cases the possible proton jumps are computed statistically. The theory gives the correct dispersion behaviour and shows that the static dielectric constant of pure ice (~ 100) is due to proton jumps at molecules adjacent to doubly occupied bonds. The theory is extended to mixed-crystals with HF. It can be concluded that at medium high HF concentrations the predominant dispersion mechanism takes place by proton transfer at H_3O^+ ions, whereas at the highest concentrations the vacant bond mechanism prevails. Finally, it is shown that the present theory of lattice imperfections in ice is consistent with all known structural and physical facts, including the zero-point energy. A.

537.311.32

3991. SILICATE GLASSES WITH ELECTRONIC CONDUCTIVITY.
O.V.Mazurin, G.A.Pavlova, E.Ya.Lev and E.K.Leko.
Zh. tekh. fiz., Vol. 27, No. 12, 2702-3 (1957). In Russian.

It is at present widely believed that SiO_2 and B_2O_3 glasses show only ionic conductivity. Alkali-free glasses containing Fe_2O_3 were examined by Tuband's method. Three plates of the glass were accurately weighed and were clamped into a pile with two Pt or stainless steel separators. The outer faces were silvered. At about 600°C a measured quantity of electricity was passed through the sandwich and the three glass elements were subsequently weighed. For a glass of composition 40 mol.% SiO_2, 10 B_2O_3, 10 Al_2O_3, 30 CaO, 10 Fe_2O_3 there was no change in weight indicating the conductivity to be electronic. If 1-2% of the conductivity had been due to ionic migration some weight change would have been detectable. Conductivity increased rapidly with Fe_2O_3 content. A.L.Mackay

537.311.33

3992. PRESSURE-INDUCED METALLIC TRANSITIONS IN INSULATORS. B.J.Alder and R.H.Christian.
Disc. Faraday Soc., No. 22, 44-6 (1956).

Experimental evidence is presented that several ionic and molecular crystals change their conductivity into the range of metallic conductivities when subjected to a pressure of about 250 000 atm. For some of these substances the pressures at which this transition occurs is roughly defined. A.

537.311.33 : 536.6

3993. SETTING UP OF A MICROCALORIMETER FOR THE STUDY OF SEMICONDUCTORS. D.Blet-Talbot.
C.R. Acad. Sci. (Paris), Vol. 245, No. 25, 2224-7 (Dec. 16, 1957).
In French.

The heating of thin selenium strips by light was tested in a carefully insulated calorimeter permitting detection of 0.5 μW, with a heat constant of about 4×10^{-4} cal deg^{-1} sec^{-1} and a time constant of about 10 sec. D.Haneman

537.311.33

3994. STATISTICS OF DIVALENT COMPENSATED IMPURITIES IN SEMICONDUCTORS. W.Mercouroff.
C.R. Acad. Sci. (Paris), Vol. 246, No. 8, 1175-7 (Feb. 24, 1958).
In French.

The introduction of a monovalent impurity of opposite type to the divalent impurity alters very markedly the rate of variation of free carrier concentration with temperature. The theory of the process is worked out and predicts the behaviour of Ge doped with Zn and compensated with Sb. C.A.Hogarth

537.311.33 : 538.245

3995. THE MANY-ELECTRON THEORY OF SEMICONDUCTORS. II. FERROMAGNETIC SEMICONDUCTORS.
Yu.P.Irkhin and E.A.Turov.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 1, 9-13 (1957). In Russian.

The many-electron model of a semiconductor derived by Vonsovskii, Irkhin, Kushnirenko and Turov [ibid., Vol. 3, 385, 1956] is applied to ferromagnetic semiconductors. This requires the consideration of spin excitons (ferromagnons) in addition to the Fermi and Bose excitons of the earlier paper. The activation energy and effective mass of excitons are shown to depend on the spontaneous magnetization of the crystal. This explains the discontinuity in the slope of the $\log \rho / T^{-1}$ curve, which is observed at the Curie point of some ferrites. A.F.Brown

537.311.33 : 621.315.59

3996. MEASUREMENT AND RECORDING OF THE SPEED OF SURFACE RECOMBINATION, OF BULK LIFE-TIMES AND OF DIFFERENCES IN CONTACT POTENTIAL.
C.Rigaux and J.M.Thuillier.
J. Electronics and Control, Vol. 4, No. 2, 175-8 (Feb., 1958).
In French.

Refers to investigations into the properties of germanium. A d.c. voltage is applied to the specimen which is also subjected to modulated light. The resulting a.c. output is due partially to photoconductivity and partly to the photomagnetoelectric effect. Under certain conditions these two components cancel out thus enabling information to be obtained about their relative magnitudes. Variations of contact potential can be measured by the "vibrating condenser" method due to Kelvin. V.G.Welsby

537.311.33 : 538.632

3997. THE EFFECT OF GEOMETRY ON HALL AND MAGNETORESISTIVE EFFECTS IN RECTANGULAR SEMICONDUCTOR SPECIMENS. H.J.Lippmann and F.Kuhrt.
Naturwissenschaften, Vol. 45, No. 7, 156-7 (1958). In German.

The problem is treated rigorously, but the results are expressed in simplified form for the special cases of long or wide specimens and for small or large Hall angles. K.W.Plessner

537.311.33 : 538.113 : 114

3998. THE MAGNETIC SUSCEPTIBILITY OF MOTT EXCITONS IN SEMICONDUCTORS. L.L.Korenblit.
Zh. tekh. Fiz., Vol. 27, No. 3, 484-94 (1957). In Russian.

The quantum mechanical treatment of free electrons and holes in a magnetic field is compared with the treatment of electron-hole bound pairs (Mott excitons). The magnetic susceptibility of the excitons is calculated. Conditions for equilibrium between a gas of free electrons and holes and an exciton gas are discussed.
A.F.Brown

537.311.33 : 538.63

3999. THE THEORY OF QUANTAL KINETIC PHENOMENA IN SEMICONDUCTORS. A.G.Samoilovich and L.L.Korenblit.
Zh. tekh. Fiz., Vol. 27, No. 12, 2673-97 (1957). In Russian.

A detailed study is made of the conductivity of semiconductors in the presence of an applied transverse or longitudinal magnetic field. A relaxation-time approach is used but conductivity is considered as an operator depending upon the external field. The quantization of the electron motion in the presence of the field is taken into account and is found to be significant at liquid-helium temperatures. Longitudinal effects, which are absent in the quasi-classical approach, are discussed. S.F.Edwards

537.311.33

4000. A METHOD OF MEASURING THE BULK LIFETIME AND DIFFUSION COEFFICIENT OF CHARGE CARRIERS BY THE MEASUREMENT OF THE CHANGE OF RESISTANCE OF A SEMICONDUCTOR IN A MAGNETIC FIELD. O.V.Sorokin.
Zh. tekh. Fiz., Vol. 27, No. 12, 2774-6 (1957). In Russian.

For a thin plate with surfaces of differing recombination velocities the variation of resistance in a magnetic field as a functio

of the frequency of applied a.c. can be used to derive values of lifetime and diffusion constant. The effect depends upon the departure of the carrier concentrations from equilibrium values in the presence of both current flow and magnetic field. (See Zhuze, Sorokin and Pikus, Zh. tekh. Fiz., Vol. 27, 1167, 1957 and also Abstr. 8774-5/1956). The technique is largely applicable to near-intrinsic material only. C.H.L.Goodman

537.311.33 : 539.2

4001. DISSOCIATION OF EXCITONS BY PHONONS IN ATOMIC SEMICONDUCTORS. A.A.Lipnik.
Zh. tekh. Fiz., Vol. 27, No. 12, 2777-9 (1957). In Russian.

An extension of the work of Ansel'm and Firsov (Abstr. 7224/1955). An expression is derived for the probability of the dissociation of an exciton as a result of interaction with acoustic modes. This extends the ranges of temperature, dielectric constant and effective masses over which Ansel'm and Firsov's expression for mean free path is valid. J.B.Arthur

537.311.33

4002. ON THE CORRELATION BETWEEN ELECTRONS IN NARROW IMPURITY BANDS IN SEMICONDUCTORS.
I.G.Samoilovich, M.I.Klinger and V.M.Nitsovich.
Zh. tekh. Fiz., Vol. 27, No. 12, 2784-5 (1957). In Russian.

The effect of correlation between electrons on the concentration and distribution of electrons in narrow impurity bands is studied, assuming that interaction takes place only between the electrons of one impurity centre. J.B.Arthur

537.311.33 : 538.632

4003. ON THE THEORY OF SEMICONDUCTORS WITH AN EXCITED IMPURITY BAND. M.I.Klinger and G.A.Makarȳcheva.
Zh. tekh. Fiz., Vol. 28, No. 2, 264-6 (1958). In Russian.

The electrical conductivity and Hall constant of a semiconductor are calculated taking into account the principal and excited impurity bands. K.F.Hulme

537.311.33

4004. THE INFLUENCE OF THE SURFACE ON THE SIGN OF THE CONDUCTIVITY IN AlSb AND InSb. V.F.Sȳnorov.
Dokl. Akad. Nauk SSSR, Vol. 118, No. 3, 483-4 (1958). In Russian.

Layers of AlSb, InSb and GaSb which show hole conduction were prepared by evaporation of n-type material in vacuo. The conductivity of AlSb and InSb as a function of powder-particle size was investigated. Powders were produced by mechanical grinding of n-type material; particle size was determined using a microscope. As the particle size decreased the thermo-e.m.f. of AlSb and InSb decreased until,at some 2-3 μ size,the thermo-e.m.f. changed sign and began to increase (evidence of the hole conduction). This change is stable at 2-300°C under vacuum, the thermo-e.m.f. being measured directly in the vacuum equipment. W.Bardsley

537.311.33 : 537.583

THERMIONIC AND SEMICONDUCTING PROPERTIES OF Ag]–Cs_2O, Ag, Cs. See Abstr. 3208

537.311.33 : 539.234

4005. THE EFFECT OF THICKNESS ON THE ELECTRICAL PROPERTIES OF BISMUTH FILMS. V.I.Kaidanov and A.R.Regel'.
Zh. tekh. Fiz., Vol. 28, No. 2, 402-11 (1958). In Russian.

The films (2.4-42 μ thick) were prepared by vacuum deposition on to a glass substrate at rates of 0.77 to 0.29 μ/min. The substrate temperature reached 95°C during deposition. Before measuring the films, they were annealed at 170°C in vacuo for 1 hour. X-ray photographs showed that the films then consisted of unoriented grains of 2-3 μ size. Measurements were carried out (–190 to +150°C) for the various film thicknesses, of the resistivities, Hall constants, and ranges of resistance in transverse magnetic fields (up to 3300 oersted). The results agreed with the theory of Fuchs (which takes into account the reduction of electron mean free path due to scattering at the edges of the films), if it is assumed that only a small fraction of the electrons are elastically reflected at the surfaces.

K.F.Hulme

537.311.33

4006. ON DEPENDENCE OF THE FORBIDDEN-BAND WIDTH ON COMPOSITION OF [SEMICONDUCTING] CdS–CdSe SOLID SOLUTIONS. R.Yu.Khansevarov, S.M.Ryvkin and I.N.Ageeva.
Zh. tekh. Fiz., Vol. 28, No. 3, 480-3 (1958). In Russian.

537.311.33 : 538.22

4007. THE ELECTRIC AND MAGNETIC PROPERTIES OF THE INTERMETALLIC COMPOUND, CdSb. I.M.Pilat.
Izv. Metallov i Metallovedenie, Vol. 4, No. 2, 232-8 (1957).
In Russian.

The electrical resistivity, thermoelectric power, Hall constant, thermal conductivity and magnetic susceptibility were measured as functions of temperature for a variety of specimens of CdSb including: stoichiometric and various small departures therefrom, and also various dopings with Al, Te, Pb, Sn, and In. Results are given in tables and graphs. In discussion it is argued that the variation of some of the measured parameters can be related to variations in the binding forces in the crystals. A.F.Brown

537.311.33 : 539.219

SOME PROPERTIES OF GALLIUM ARSENIDE–GERMANIUM MIXTURES. See Abstr. 3486

537.311.33

4008. EFFECT OF IMPURITY BANDS IN GERMANIUM DOPED WITH ZINC AT VERY LOW TEMPERATURES. W.Mercouroff.
C.R. Acad. Sci. (Paris), Vol. 246, No. 7, 1013-15 (Feb. 17, 1958). In French.

Ge crystals doped to 10^{16}-10^{17} atoms/cm^3 of Zn and compensated with Sb exhibited a conductivity and Hall effect which at 20-30°K varied with applied field. The sign of the Hall effect varied from p- to n-type as the applied field increased. C.A.Hogarth

537.311.33

4009. DIFFUSION AND ELECTRICAL STATE OF THERMAL ACCEPTORS IN GERMANIUM. V.A.Zhidkov and V.E.Lashkarev.
Zh. tekh. Fiz., Vol. 27, No. 5, 877-83 (1957). In Russian.

Electrical self-heating of germanium to high temperatures was shown to lead to removal of thermal acceptors, not only by evaporation, but also by absorption in the Ta electrodes. Loss by such absorption predominated on heating in helium as opposed to vacuum. Above ~800°C the rate of loss of acceptors was much increased when d.c. was used for heating; it was found that acceptors then possessed unit positive charge, but were neutral at lower temperatures. The diffusion constant for acceptors was 1.2 exp(–1.1 eV/kT) at 630-930°C. See also Abstr. 2428 and 8283 (1954).

C.H.L.Goodman

537.311.33 : 537.312.5 : 535.345

OPTICAL ABSORPTION BY FREE HOLE–ELECTRON PAIRS IN A GERMANIUM SINGLE CRYSTAL. See Abstr. 3879

537.311.33 : 538.61 : 535.376

AN ELECTROMAGNETOLUMINESCENCE EFFECT IN GERMANIUM. See Abstr. 3896

537.311.33

4010. TEMPERATURE DEPENDENCE OF CARRIER LIFETIME IN SILICON. D.J.Sandiford.
Proc. Phys. Soc., Vol. 71, Pt 6, 1002-6 (June, 1958).

Measurements of carrier lifetime have been made on both n- and p-type silicon crystals over the temperature range 0°C to 200°C. Results are given for both high and low values of injected carrier concentrations. A comparison is made with the Shockley–Read picture of carrier recombination. The results and theory may be reconciled on the assumption that the capture probabilities of the recombination centres are temperature dependent, and that the energy levels of the centres lie 0.45 ± 0.05 eV above the valence band. A.

537.311.33 : 669.054

PROPERTIES OF ZONE-PURIFIED SILICON. See Abstr. 3626

537.311.33 : 538.222

PARAMAGNETIC RESONANCE OF SILICOCARBON. See Abstr. 3251

537.311.33

4011. MINORITY CARRIER LIFETIME IN P-N JUNCTION DEVICES. M.Byczkowski and J.R.Madigan.
J. appl. Phys., Vol. 28, No. 8, 878-81 (Aug., 1957).

A relation between minority carrier lifetime and recovery time was obtained for p-n junction rectifiers of arbitrary base-width. In the limiting cases of base-width large or small compared with a diffusion length, the recovery time is found to depend on the lifetime or on the transit across the base region, respectively. In intermediate cases, the recovery time is a function of both the lifetime and the transit time. Recovery time measurements on diffused junction silicon rectifiers as a function of base-width were found to be in satisfactory agreement with the theory. A.

537.311.33 : 621.382

4012. THE DEPENDENCE OF THE INJECTION EFFICIENCY OF A P–N JUNCTION ON ITS STRUCTURE AND OPERATING CONDITIONS. K.B.Tolpȳgo.
Zh. tekh. Fiz., Vol. 27, No. 5, 884-98 (1957). In Russian.

The dependence of the injection coefficient of a plane p–n junction on the nature of the variation in impurity concentration on

either side is studied. Linear and exponential variations of acceptor concentration for constant donor concentration are examined. The possible effect of acceptors on the minority-carrier lifetime is taken into account. The method of measuring injection coefficient is criticised. An interpretation of the empirical formulae used in the manufacture of transistors and choice of optimum working conditions is given. J.B.Arthur

537.311.33 : 621.382

4013. ALLOY-DIFFUSION: A PROCESS FOR MAKING DIFFUSED-BASE JUNCTION TRANSISTORS. J.R.A.Beale.
Proc. Phys. Soc. B, Vol. 50, Pt 11, 1087-9 (Nov., 1957).

A small mass containing both donor and acceptor impurities is heated in contact with one surface of a semiconductor crystal. The impurities are so chosen that the slow diffusing one is highly soluble, while the impurity of opposite type to that of the crystal diffuses fast, giving a transistor of base width determined by the difference in diffusion depths of the two impurities. Using Pb containing 1% Sb and 2% Ga on p-type Ge, α cut-off frequencies of 150 to 200 Mc/s were achieved with good emitter and collector reverse characteristics. D.Haneman

537.311.33 : 621.314.632

4014. THE EFFECT OF SURFACE TREATMENT ON THE PROPERTIES OF COPPER OXIDE RECTIFIERS.
F.A.Makovskii and E.P.Usachev.
Zh. tekh. Fiz., Vol. 27, No. 12, 2786-8 (1957). In Russian.

A comparison was made of the relative efficacy of etching and of grinding the surface prior to deposition of the silver electrode, taking forward current and rectification ratio at one volt as criteria. Measurements were made on a large number of commerical rectifiers. In every case, grinding was better than etching. Acid treatment was found to form a chemical surface layer whose rectification direction was opposite to that of the copper oxide rectifier. This would account for the reduction in forward current on etching and the corresponding increase when the layer was ground off. J.B.Arthur

537.311.33 : 541.133

4015. RECTIFICATION EFFECTS AT CONTACTS BETWEEN GERMANIUM AND AN ELECTROLYTE.
G.Déjardin, G.Mesnard and A.Dolce.
C.R. Acad. Sci. (Paris), Vol. 246, No. 7, 1016-18 (Feb. 17, 1958). In French.

Discussion of the rectification behaviour of Ge/electrolyte contacts and of the form of V—I characteristics which occur. C.A.Hogarth

537.311.33

4016. CHARACTERISTICS OF JUNCTIONS IN GERMANIUM.
N.J.Harrick.
J. appl. Phys., Vol. 29, No. 5, 764-70 (May, 1958).

Infrared radiation was used to obtain a direct measure of the added carrier concentrations immediately adjacent to a junction when a current was passing through it. The current v. carrier density characteristics thus determined can provide sensitive tests of junction theory. For junctions between two highly doped germanium regions and low injection levels, the experimental results agree with existing theory. For these junctions and high injection levels, or for junctions between regions where one or both sides may be lightly doped and for arbitrary levels of injection, it is necessary to extend the theory. This is done by extending the boundary conditions for higher levels of injection and using the current equations in the ambipolar form, where the field as well as the diffusion currents are considered. The resulting current v. carrier density relationship involves the total current and takes into account, for both sides of the junction, the change in conductivity with injection level and the change in the drift length with the applied electric field. If, in addition, the change in lifetime with injection level is taken into consideration, good agreement obtains between experiment and theory. Current—voltage relationships are also derived which contain the above mentioned improvements. A.

537.311.33

4017. STUDY OF INJECTING AND EXTRACTING CONTACTS ON GERMANIUM SINGLE CRYSTALS. L.Y.Lin.
Rev. sci. Instrum., Vol. 28, No. 3, 187-8 (March, 1957).

The density of minority carriers in a Ge crystal can be altered near a rectifying contact. A procedure is described for preparing reproducible and dependable injecting and extracting contact, in order to obtain a good exponential decay or rise curve of minority carriers for determining their lifetimes by the Many bridge method. It is found that the rectifying and ohmic contacts to a single crystal must be considered together. A

537.311.33

4018. RECTIFYING EFFECTS OF SODIUM CHLORIDE CRYSTALS. S.Császár.
Nature (London), Vol. 181, 1158 (April 19, 1958).

A thin crystal having an evaporated gold electrode on one side and a point contact on the other was found to rectify at a temperature of 250°C. Electrolytically introduced colour centres increased the rectifying effect, as did the application of a reverse bias (point positive) for a prolonged period. K.W.Plessner

537.311.33 : 538.632 : 621.315.59 : 621.373.1

4019. GALVANOMAGNETIC OSCILLATORS. V.N.Bogomolov.
Zh. tekh. Fiz., Vol. 27, No. 4, 663-74 (1957). In Russian.

Two kinds of oscillator are described. The first uses the Hall voltage in a semiconducting slab to supply the current to sustain the magnetic field. The maximum theoretical efficiency is about 3%. The second type uses the resistance change that occurs when a semiconductor is placed in a magnetic field. The circuit is arranged so that this resistance change controls the current through the magnet coil, which is tuned by a capacitor. The coil may be in series or in parallel with the semiconductor. Kirchhoff's equations are set up and the conditions for oscillation are derived. The theoretical maximum efficiency is 37.5%. A material with a high carrier mobility would be required, and InSb is suggested. J.B.Arthur

537.311.33.092 : 621.382 : 621.317.79

4020. AN APPARATUS FOR MEASURING THE PIEZORESISTIVIT OF SEMICONDUCTORS. R.F.Potter and W.J.McKean.
J. Res. Nat. Bur. Stand., Vol. 59, No. 6, 427-30 (Dec., 1957).

A tensile force up to 1 kg can be applied to the sample by means of a calibrated beam balance. The apparatus was used for measurements on InSb over the range from 78° to 300°K, and tensile stresses of the order of 5×10^7 dyn/cm^2 can be applied to samples that are cut in a special manner. A.

537.312.5

4021. PHOTOCONDUCTIVITY OF CADMIUM OXIDE.
J.Janin and L.Cotton.
C.R. Acad. Sci. (Paris), Vol. 246, No. 10, 1536-8 (March 10, 1958). In French.

Measurements were made with pure CaO, and CaO activated with Pb, Mn and Sm. Photoconduction occurred under irradiation with 1850 A independent of the activator. Irradiation with u.v. light of longer wavelength and with infrared (causing luminescence and stimulation in activated specimens) had little effect on photoconductivity. J.Franks

537.312.5 : 539.234

4022. PREPARATION AND PHOTOCONDUCTIVE PROPERTIES OF CADMIUM TELLURIDE FILMS.
G.G.Kretschmar and L.E.Schilberg.
J. appl. Phys., Vol. 28, No. 8, 865-7 (Aug., 1957).

CdTe was made by combining purified cadmium and tellurium in stoichiometric proportions in an evacuated Vycor tube. Thin films of this material were deposited by condensation across the short gaps between Aquadag electrodes in Dewar-type tubes. These films have a high resistance at room temperature and show a large photoconductive effect, with a peak response at about 0.8 μ. When the films are deposited in the presence of indium vapour, the dark resistance can be brought down to a value of approximately 1 to 10 megohms for a film of 0.5 mm in width. The resistance of the films under illumination will then be a few tenths of a megohm. Iodine vapour will also reduce the dark resistance of cadmium telluride films, but the photoconductive effect almost disappears. A.

537.312.5

4023. SURFACE PHOTOCONDUCTIVITY OF CADMIUM SULPHIDE MODIFIED WITH MAGNETIC FIELD.
S.Tanaka and T.Masumi.
J. Phys. Soc. Japan, Vol. 13, No. 1, 22-32 (Jan., 1958).

An experiment on the changes of photocurrent in CdS single crystals in a magnetic field was performed. The changes are dependent on: the strength of electric and magnetic fields which are parallel to the illuminated surface and are perpendicular to each other; the frequency of the alternating electric field; the wavelength of the illuminating light; and the ambient atmosphere. The changes are independent of the intensity of the illuminating light. Some theoretical treatments based on the phenomenological theory of surface recombination are proposed, and would seem to give some information about surface recombination of CdS single crystals. A.

537.312.5 : 537.531.9

4024. PHOTOELECTRIC RESPONSE OF SELENIUM-TYPE PHOTOVOLTAIC CELLS TO X-RAYS. R.Feinberg.
Nature (London), Vol. 181, 1057 (April 12, 1958).

537.312.5 : 535.371

4025. ELECTRONIC PROPERTIES OF AROMATIC HYDROCARBONS. IV. PHOTOELECTRIC EFFECTS.
D.C.Northrop and O.Simpson.
Proc. Roy. Soc. A, Vol. 244, 377-89 (March 25, 1958).

For Pt III see Abstr. 6720 (1957). Reliable measurements of photoconductivity in aromatic hydrocarbons are not easy to make, owing to rapid photo-oxidation in air and spurious space-charge effects with certain electrode systems. A technique of growing thin single crystals sealed between glass flats is described which overcomes both difficulties. The magnitude of the photoconductivity observed with these specimens does not vary greatly from one pure hydrocarbon to another. Absorption of light in the fundamental band of an aromatic hydrocarbon crystal results in fluorescence as well as photoconductivity. The light produces excitons which may revert to the ground state with emission of fluorescence, but do not transport charge. Additional energy is needed to generate photocarriers by ionizing the excited molecules, and it is not obvious where this energy comes from. An explanation based on the intensity dependence of photocurrent attributes the carriers to the decay of excitons, but unlike the unimolecular decay governing the fluorescence emission the interaction of two excitons is required to produce a single ionized molecule. Twice the fundamental energy thus becomes available to ionize one molecule. The theory requires photoconductivity and fluorescence to be directly proportional to the exciton density, so that both should be quenched equally by impurities which trap excitons. It was confirmed experimentally that the addition of an impurity which quenches the fluorescence of a hydrocarbon also reduces the photocurrent in the same ratio. This is true over a wide range of concentration and for impurity molecules with different quenching efficiencies. Using quantities derived in earlier parts of this series an approximate value of 5×10^{-3} $cm^2 V^{-1} sec^{-1}$ is found for the mobility of the carriers in anthracene. A.

537.312.5 : 551.521.1 : 621.311.25 : 621.383.8

4026. CONVERSION OF SOLAR TO ELECTRICAL ENERGY.
G.L.Pearson.
Amer. J. Phys., Vol. 25, No. 9, 591-8 (Dec., 1957).

A photovoltaic device was developed which converts solar radiation directly into electrical energy with an over-all efficiency of 11%. It consists of a p-n junction formed by gaseous diffusion near the front surface of a silicon plate. In full sunlight a single cell furnishes approximately 30 mA of short circuit current per cm^2 of surface, 0.6 V of open circuit voltage and 12 mW of power into a matched load per cm^2 of surface. Like other electric batteries, individual cells may be connected in series or parallel to obtain an increase in terminal voltage or current. The spectral response is a maximum near 0.7 μ, and the long wavelength cut-off is at approximately 1.1 μ. The efficiency of this new silicon p-n junction photovoltaic cell is greater by a factor of 20 than that previously reported for other types of photocell, and makes the conversion of solar energy directly into electricity possible for a number of interesting applications. A field trial at Americus, Georgia, in which solar batteries are used to power a rural carrier telephone communication system, is described. A number of other possible applications for this new solar energy converter are discussed. A.

537.312.5 : 551.521.1

4027. SILICON SOLAR BATTERIES AS SOURCES OF ELECTRICAL SUPPLY FOR ARTIFICIAL EARTH SATELLITES.
V.S.Vavilov, V.M.Malovetskaya, G.N.Galkin and A.P.Landsman.
Uspekhi fiz. Nauk, Vol. 63, No. 1a, 123-9 (1957). In Russian.

The mode of action is discussed of a semiconductor energy converter, with its V—A and load characteristics. The operational temperature conditions of a solar battery are considered.
C.R.S.Manders

537.312.5 : 537.531

4028. THE OCCURRENCE OF ELECTROMOTIVE FORCES IN AMORPHOUS SELENIUM UNDER THE ACTION OF X-RADIATION.
V.I.Kolomoitsev and F.F.Kodzhespirov.
Zh. tekh. Fiz., Vol. 27, No. 5, 899-904 (1957). In Russian.

A photo-e.m.f. has been observed in amorphous Se irradiated with X-rays. The growth and decay curves of the effect are exponential, the time constants depending on the dark resistance, temperature and radiation intensity. The dependence of the photo-voltage on temperature and intensity suggests that crystal diffusion theory applies.
J.B.Arthur

537.312.5

4029. ON THE DETERMINATION OF THE PARAMETERS OF SILVER SULPHIDE BARRIER-LAYER PHOTOCELLS.
S.V.Svechnikov.
Zh. tekh. Fiz., Vol. 27, No. 5, 914-18 (1957). In Russian.

The barrier-layer resistance and capacity were deduced from measurements of the time constants of the switching-on and -off transients of commercial (Russian) Ag_2S photocells. The parameters were measured at various intensities and wavelengths of incident illumination. The capacity tended to a minimum and the resistance to a maximum at 0.9 μ, the wavelength of maximum sensitivity.
J.B.Arthur

537.312.5

4030. SOME PHOTOELECTRIC PROPERTIES OF CdSe AND CdTe SINGLE CRYSTALS. S.V.Svechnikov and V.T.Aleksandrov.
Zh. tekh. Fiz., Vol. 27, No. 5, 919-20 (1957). In Russian.

Single crystals were grown by vapour-phase reaction; dark resistances were $\sim 10^6$ - 10^9 ohms for CdSe and $\sim 10^8$ - 10^{10} ohms for CdTe. The corresponding thermal activation energies were 0.53 and 0.47 eV respectively, while photoconductivities peaked at ~ 0.76 and ~ 1.0 μ. Photoconductive sensitivity reached ~ 100 amp/lumen with CdSe, ~ 500 mA/lumen with CdTe. Both materials (CdTe in particular) showed appreciable photoconductive inertia. Comparison is made with properties of CdS.
C.H.L.Goodman

537.312.62

4031. CRITICAL CURRENT IN SUPERCONDUCTING FILMS.
V.L.Ginzburg.
Dokl. Akad. Nauk SSSR, Vol. 118, No. 3, 464-7 (1958). In Russian.

The problem is discussed in terms of the Ginzburg—Landau theory (Abstr. 1017/1952), but in a note added on proof it is pointed out that in view of the Bardeen, Cooper and Schrieffer theory (Abstr. 6193/1957), the discussion is likely to be of only limited validity.
D.Shoenberg

537.312.62

4032. CONDUCTIVITY OF SUPERCONDUCTING FILMS: A SUM RULE. R.A.Ferrell and R.E.Glover.III.
Phys. Rev., Vol. 109, No. 4, 1398-9 (Feb. 15, 1958).

It is shown from the Kramers-Kronig relations that if the real part of the conductivity σ_1 is integrated over all frequencies, the value of the integral must be the same in the normal (n) and superconducting (s) states. At zero frequency $\sigma_1(s)$ has a delta function contribution, the strength of which can thus be deduced from the integral of $\sigma_1(n) - \sigma_1(s)$ over all frequencies above zero. The value so found agrees well with the values deduced in other ways.
R.G.Chambers

537.312.62 : 621.375.2.024

4033. A SENSITIVE SUPERCONDUCTING "CHOPPER" AMPLIFIER. A.R.de Vroomen and C.van Baarle.
Physica, Vol. 23, No. 8, 785-94 (Aug., 1957).

A d.c. chopper amplifier is described, similar to that of Templeton (Abstr. 7980/1955), for use where the source impedance is extremely small. The input chopper is a superconducting wire periodically brought into the normal resistive state by an a.c. magnetic field. The d.c. sensitivity is better than 10^{-11} V.
R.G.Chambers

537.312.62 : 536.212

THERMAL CONDUCTIVITY OF SUPERCONDUCTING LEAD AND TIN. See Abstr. 3922-3

537.312.7

4034. THE CHANGE OF CONDUCTIVITY OF KBr IN STRONG FIELDS IN THE TEMPERATURE RANGE 300-450° C.
V.F.Pisarenko.
Dokl. Akad. Nauk SSSR, Vol. 115, No. 5, 898-900 (1957). In Russian.

Over a restricted temperature range, with fields of 1000 to 10 000 V/cm, KBr crystals showed, after a short delay, a sharp rise in conductivity (by a factor of 10^2-10^3). After rapid cooling such crystals possessed enhanced room-temperature conductivity and though they were photoconductive (response from ~1 to > 3 eV, with a weak peak near 1.9 eV) their absorption spectrum showed no change compared with normal crystals. This behaviour is interpreted in terms of an interaction between crystal imperfections and an electrolytic process (see also Kosman and Pisarenko, Abstr. 3128/1958).
C.H.L.Goodman

537.312.8 : 538.632

4035. THE HALL EFFECT AND THE EFFECT OF A MAGNETIC FIELD ON RESISTANCE OF MAGNETITE.
A.A.Samokhvalov and I.G.Fakidov.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 2, 249-56 (1957).
In Russian.

The paper reports measurements of the Hall effect and change of resistance of natural magnetite in magnetic fields of magnitudes including the region of saturation of magnetite. It is shown that conduction electrons in both of the above galvanomagnetic effects are acted upon by the same effective magnetic field $H_{eff} = H_i + 4\pi\alpha M$, where the effective-field parameter α is different in sign and magnitude for each of these effects. The relationship between the Hall effect and change of resistance in a magnetic field is discussed.
S.Chomet

537.312.8 : 534.39

4036. ACOUSTOMAGNETOELECTRIC EFFECTS IN METAL AND SEMICONDUCTOR FILAMENTS. G.G.E.Low.
Proc. Phys. Soc., Vol. 71, Pt 6, 965-72 (June, 1958).

The interaction of a magnetic field and a compressional acoustic wave travelling in a conducting medium is considered and expressions for the electric current densities and fields in filamentary-shaped specimens are derived on the assumption of charge neutrality. Calculations appropriate to metals and to semiconductors are carried out, the latter materials being of interest as the presence of charge carriers of both signs makes possible changes in carrier concentration without violation of the neutrality assumption. In addition, second-order acoustomagnetoelectric effects are discussed. A.

537.312.9

4037. EFFECT OF PLASTIC DEFORMATION ON THE ELECTRICAL RESISTIVITY OF CHROMIUM. M.E.de Morton.
Nature (London), Vol. 181, 477-8 (Feb. 15, 1958).

Below a transition temperature of around 40°C a deformed specimen of high-purity chromium had a lower resistivity than the annealed material. A minimum in the resistivity–temperature curve for the annealed material occurs at 41°C. D.M.Edwards

537.322

4038. THE VOLUME PELTIER EFFECT IN GERMANIUM.
P.I.Baranskiĭ.
Zh. tekh. Fiz., Vol. 28, No. 2, 225-30 (1958). In Russian.

The volume Peltier effect is expected to be present in a semiconductor with non-uniform resistivity; it consists of the absorption or generation of heat when a direct current, I, is passed through the material. The experimental arrangement used to detect the effect in germanium single-crystal specimens is described; six specimens with average resistivities 0.018 to 0.61 ohm cm were studied. The results show that the effect is proportional to I as expected. If there is a volume Peltier effect, there should also be a gradient of thermoelectric force; the apparatus used to detect this effect is also described.
K.F.Hulme

537.323

4039. THERMOELECTRIC POWER OF IONIC CRYSTALS.
R.E.Howard and A.B.Lidiard.
Disc. Faraday Soc., No. 23, 113-21 (1957).

The thermoelectric power of an ionic conductor MX fitted with electrodes of metal M is discussed from the point of view of the lattice defects existing in the salt. This power is composed of two parts: (1) a "homogeneous" part (coming from the thermal diffusion potential caused by the temperature gradient in the salt), which is related to the "heats of transport" of the defects; and (2) an "inhomogeneous" part (coming from the dependence of M/MX contact potential on temperature), which is related to the entropies of formation of the defects. Detailed results are given for the case where MX is a cationic conductor showing Frenkel disorder, and the influence of impurities of type NX_2 in MX is discussed. When the lattice disorder is dominated by the presence of impurities the total power contains an important concentration dependent term $-(k/e)\ln[c(1-p)]$, where c is the molar fraction of impurity and p the degree of association between impurity N^{2+} ions and M vacancies (k, e are respectively, Boltzmann's constant and the electronic charge). The power of an impure crystal is found to be unaltered by the establishment of a Soret concentration gradient. Agreement between present theory and the existing, rather scant, data on AgBr is adequate but further, experiments on AgBr and AgCl are desirable. A.

537.323 : 538.632 : 537.311.31

THERMOELECTRIC POWER OF GAMMA BRASS. See Abstr. 3987

ELECTRIC DISCHARGES

537.521 : 621.387

4040. FORMATION OF A PULSE DISCHARGE IN ARGON AT VERY HIGH FREQUENCIES. I. ELECTRON VELOCITY DISTRIBUTION FUNCTION. V.E.Golant.
Zh. tekh. Fiz., Vol. 27, No. 4, 756-70 (1957). In Russian.

Derives an approximate value of electron velocity distribution function under conditions suitable for a pulse discharge in argon for very-high-frequency pulses of 10^{-6} sec duration. Derivation is based on analysis of existing experimental knowledge of elastic and inelastic collisions of electrons with argon atoms. The distribution function is used to derive: (a) coefficient of ionization of argon atoms by electrons, (b) high-frequency conductivity of argon, (c) coefficient of capture of electrons by water molecules. The significance of the analysis with reference to t–r tubes used in radar is pointed out.
J.M.Zarzycki

537.521 : 621.387

4041. FORMATION OF A PULSE DISCHARGE IN ARGON AT VERY HIGH FREQUENCIES. II. FORMATION OF A DISCHARGE BY RECTANGULAR POWER PULSES. V.E.Golant.
Zh. tekh. Fiz., Vol. 27, No. 4, 771-83 (1957). In Russian.

The critical value of the amplitude of electric field intensity is introduced as a criterion for the initiation of a discharge. It is derived from the previous (see preceding abstract) calculation of the coefficient of ionization of argon atoms by electrons and high-frequency conductivity of argon. Theoretical values are compared with results of experiments carried out with pulses of 2800 Mc/s frequency and 10^{-6} sec duration. J.M.Zarzycki

537.521.7 : 535.332 : 535.89

EMISSION OF LIGHT FROM ELECTRIC DISCHARGES OF MICROSECOND DURATIONS IN GASES AT ATMOSPHERIC PRESSURE. See Abstr. 3912

537.525 : 538.691

4042. CONFINEMENT OF CHARGED PARTICLES BY A MAGNETIC FIELD. B.Lehnert.
Nature (London), Vol. 181, 331-2 (Feb. 1, 1958).

A short note discussing confinement by axially symmetrical stationary magnetic fields and electric fields. A particular case is discussed, and a numerical example (deuterium at 10^6 °K, magnetic field 3×10^5 gauss, coil radius 5 m) is taken.
J.D.Craggs

537.525

4043. EFFECTS OF ELECTRON–ELECTRON INTERACTIONS ON CYCLOTRON RESONANCES IN GASEOUS PLASMAS. R.C.Hwa.
Phys. Rev., Vol. 110. No. 2, 307-13 (April 15, 1958).

The effect of mutual interactions between electrons on the cyclotron resonance of a gaseous discharge plasma has been studied. From the Boltzmann–Fokker–Planck equation in cylindrical coordinates, a set of simultaneous integro-differential equations are obtained, and they are solved numerically on a digital computer for various values of magnetic field and electron density. The results indicate that the real part of the electrical conductivity of the plasma, and hence its power absorption, are reduced by the electron–electron interactions at the peak of the resonance, and that the width of the resonance is increased. The broadening of the resonance width becomes increasingly pronounced at higher charge concentrations. It is also found that, with the magnetic field equal to zero, the high-frequency conductivity of the plasma is practically unaltered by the electron–electron interactions. Thus the usual expression for the electrical conductivity of a Lorentzian gas cannot be used without discretion for high-density plasmas, where mutual electronic encounters cannot be ignored. A.

537.525

4044. CONNECTION BETWEEN LANGMUIR PROBE-CHARACTERISTIC METHOD AND THE METHOD OF TWO PROBES IN DETERMINATION OF ELECTRON TEMPERATURE.
V.I.Tverdokhlebov.
Zh. tekh. Fiz., Vol.27, No. 4, 753-5 (1957). In Russian.

A general equation for determination of electron temperature is derived, from which Langmuir and Mott–Smith equations as well as

that for the double-probe method are obtained as special cases. It is pointed out that intermediate formulae can be used in the case of asymmetric characteristics in the double-probe method.

J.M.Zarzycki

537.525 : 539.17

PRODUCTION OF HIGH TEMPERATURES AND NUCLEAR REACTIONS IN A GAS DISCHARGE. See Abstr. 3391

537.525.3

4045. STARTING POTENTIAL FOR THE COAXIAL CYLINDER CORONAS IN HYDROGEN UNDER LOW FREQUENCY SILENT ELECTRIC DISCHARGE. D.P.Jatar.
Nuovo Cimento, Vol. 8, No. 2, 290-5 (April 16, 1958).

The starting potential was measured over a range of pressure from 3 to 700 mm Hg. It is suggested that the starting potential is analogous to the intermittent pre-onset burst pulse corona. The other onset potentials are evaluated from the current–potential characteristics and agree closely with those evaluated from the variation of the Joshi effect. A.

537.525.8

4046. SIMULTANEOUS OCCURRENCE OF MOVING AND STANDING WAVES IN A POSITIVE COLUMN.
A.W.M.Cooper, J.R.M.Coulter and K.G.Emeléus.
Nature (London), Vol. 181, 1326-7 (May 10, 1958).

Describes experiments, with a rotating-mirror apparatus, on the simultaneous observation of fixed and moving striations in a low-pressure (a few mm Hg) neon discharge. The observations are briefly discussed. J.D.Craggs

537.528 : 534.2

4047. ELECTRO-ACOUSTICAL EFFICIENCY OF A SPARK DISCHARGE IN WATER. N.A.Roĭ and D.P.Frolov.
Dokl. Akad. Nauk SSSR, Vol. 118, No. 4, 683-6 (1958). In Russian.

The electro-acoustical efficiency increases with increasing spark-gap length and can reach a maximum value of 30%. At a constant spark-gap length the efficiency decreases, if the electrical energy of a discharge is increased by increasing the discharging capacitance and keeping the voltage constant. Z.Krasucki

537.529 : 621.315.61.015.5

4048. EFFECT OF THE CATHODE MATERIAL ON THE BREAKDOWN STRENGTH OF AMORPHOUS DIELECTRICS. J.J.O'Dwyer.
Rep. Brit. Elect. Res. Assoc., Rep. L/T 263, 8 pp. (1951).

The intrinsic breakdown strength of amorphous dielectrics has been calculated by Fröhlich on the basis of a fairly general model of an amorphous dielectric. Using the same model, it has been shown in reports Refs. L/T 178 (Abstr. 3216/1949) and L/T 220 (1949) that the intrinsic breakdown time should be less than 10^{-10} sec for almost all substances of this type. The purpose of the present investigation is to interpret breakdown experiments in the light of the above theory, with particular reference to the cathode material. A.

X-RAYS

537.531 : 535.345 : 539.2

4049. ON THE THEORY OF THE FINE STRUCTURE OF THE X-RAY ABSORPTION SPECTRA OF SOLIDS. V.A.Trapeznikov.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 1, 8-16 (1957).
In Russian.

A.I.Kostarev (Abstr. 5146/1952) has considered the connection between relative intensities of the fine X-ray absorption spectra of solids and the temperature and concentration. A detailed analysis is given in the present paper and the results of the theory are compared with experimental data. T.Mulvey

537.531 : 535.43

4050. THE THEORY OF DIFFUSE SCATTERING OF X-RAYS BY TERNARY ALLOYS. M.A.Krivoglaz.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 2, 203-11 (1957).
In Russian.

Formulae are derived relating the intensity of scattering of monochromatic X-rays to the scattering angle, crystal orientation, alloy composition, temperature and the degree of interaction between neighbouring atoms. Similar formulae should be applicable to the scattering of thermal neutrons. A.F.Brown

537.531 : 535.33.07

4051. A NEW BENT CRYSTAL SOFT X-RAY VACUUM SPECTROGRAPH. B.Mitra and K.Das Gupta.
J. sci. industr. Res., Vol. 16B, No. 12, 524-7 (Dec., 1957).

The crystal holder and the casette are fixed permanently in the vacuum chamber, and the source or target is movable. The special merits of the instrument are: (1) the photomultiplier detectors can be conveniently operated in vacuum along with the fixed Rowland circle; and (2) the reduction in the size of the vacuum chamber facilitates the maintaining of a high vacuum. Dispersions of the order of 16 X-unit/mm in the eighth order of $CuK_{\alpha_1\alpha_2}$ can be obtained. A.

537.531 : 535.33.07 : 539.166.08

4052. CRYSTAL REFLECTIVITY IN BENT CRYSTAL SPECTROMETERS. A.J.Cochran and M.A.S.Ross.
Proc. Phys. Soc., Vol. 71, Pt 6, 1011-14 (June, 1958).

Previous work on the coefficient of reflection R of bent crystals used in transmission-type focusing γ-ray spectrometers has shown a power law dependence on wavelength λ for λ less than 0.5 A. Theory is here presented which suggests that at longer wavelengths the power law does not hold and that R reaches a maximum. The wavelength corresponding to R_{max} depends on the assumptions made about the amount of secondary extinction occurring but could be about 1 A. An experiment on a bent mica crystal shows that R is proportional to $\lambda^{1.9}$ for λ less than 0.5 A and seems to confirm the existence of a maximum near 1 A. A.

537.531 : 535.33.07

4053. SENSITIVE, QUANTITATIVE RECORDING X-RAY SPECTROMETER. G.E.B.Barstad and I.N.Refsdal.
Rev. sci. Instrum., Vol. 29, No. 5, 343-8 (May, 1958).

A spectrometer was developed with the object of achieving a high diffraction efficiency, low background, and stability and convenience in operation. A mechanism is used to position the detector and crystal in relation to the sample, for determining extended spectra by Johann's and Cauchois' methods. Sample-chambers with radiation shielding walls are used, and the outlet for fluorescent radiation is designed for reducing background. Microsamples can be used to simplify the evaluation of quantitative results. A vacuum-chamber was designed for further reducing background. 4 × 7 cm crystal lamellae on glass supports are prepared from blocks of NaCl or LiF and bent cylindrically for line focusing, or double-curved for point-focusing to increase the intensity at particular wave-lengths; the focusing always being aberration-free. The equipment was calibrated for microquantitative determination of 30 elements, and an absolute sensitivity of 2×10^{-10} g was achieved for the elements Co–Zn. A.

537.531 : 535.43

4054. COLLIMATION CORRECTION IN LOW-ANGLE X-RAY SCATTERING. V.N.Filipovich.
Zh. tekh. Fiz., Vol. 27, No. 5, 1029-44 (1957). In Russian.

Theory of the correction (Abstr. 7453/1956) is developed further and a full solution given for the case of a rectangular slit and homogeneous beam. The displacement and possible suppression of maxima in the scattered X-ray distribution are discussed.

Metallurgical Abstracts

537.531.08

4055. THE RECORDING OF X-RAY INTERFERENCE PATTERNS BY MEANS OF A COUNTER TUBE AND A CADMIUM SULPHIDE CELL. COMPARATIVE MEASUREMENTS. H.Rothe and L.Kramer.
Exper. Tech. der Phys., Vol. 5, No. 1, 17-33 (1957). In German.

Simple X-ray spectra were recorded using a Geiger-Müller counter and a CdS cell. For the latter a h.t. supply with half-wave rectification was used to modulate the X-ray beam so that a.c. amplifiers could be used. It was not possible to determine the quantum efficiency of the CdS cell, but it is thought that for many applications in the range from 0.5 to 2.3 A a CdS cell can usefully replace a Geiger-Müller counter. T.Mulvey

537.531.9 : 537.312.5

PHOTOELECTRIC RESPONSE OF SELENIUM-TYPE PHOTOVOLTAIC CELLS TO X-RAYS. See Abstr. 4024

CATHODE RAYS. POSITIVE RAYS

537.533

4056. EFFECT OF VARIATION OF D.C. CURRENT IN A MODULATED ELECTRON BEAM. I.P.Shkarofsky.
J. appl. Phys., Vol. 29, No. 2, 222-3 (Feb., 1958).

A brief note on some experimental results obtained with a variable space, two-cavity, apparatus. For a given separation, the modulation introduced on the beam by means of the first cavity will give an output from the second which goes through a series of

maxima and minima as the beam current is increased. Although the current values at which the maxima are observed are in good agreement with simple space-charge wave-theory, the ratio of the output powers measured show large discrepancies, which are not understood. E.A.Ash

537.533 : 537.534

4057. NONLINEAR EFFECTS IN ALTERNATING-GRADIENT SYNCHROTRONS. P.A.Sturrock.
Ann. Phys. (New York), Vol. 3, No. 2, 113-89 (Feb., 1958).

Resonances in the betatron oscillation mechanism due to non-linear effects are investigated by a perturbation method. The static theory is dealt with mainly, the acceleration process and synchrotron oscillation being ignored. The critical relationships between the phase change of radial and vertical oscillations, with which the resonances are associated, are discussed. It is shown that the combined influence of linear fluctuations of the magnetic field with the average non-linear contribution is of comparable importance to the effects of fluctuations in the non-linear contribution. Some calculations are given on the dynamic problem, i.e. the influence of synchrotron oscillation and progressive saturation of the magnets on the betatron oscillation mechanism. The two extremes of a slow and rapid traversal of a resonance are considered. The effect of repeated rapid traversals may under some conditions lead to a progressive expansion of the entire beam. J.W.Sturgess

537.533

4058. ON TRAVELLING-WAVE ELECTRON ACCELERATORS INCORPORATING THEIR OWN HIGH-FREQUENCY ENERGY SOURCE. R.Warnecke, H.Leboutet and G.Vincent.
C.R. Acad. Sci. (Paris), Vol. 246, No. 9, 1399-401 (March 3, 1958). In French.

Methods of incorporating a h.f. generator in the same envelope as the accelerator are presented. Excessive length is avoided by making the accelerator structure act as its own h.f. generator. Acceleration results from the interaction of a primary beam with the fundamental space wave and the h.f. energy from the interaction of a second beam travelling in the reverse direction with the first space harmonic of the same wave. J.W.Sturgess

537.533

4059. ON A NEW TYPE OF ELECTRON LINEAR ACCELERATOR INCORPORATING ITS OWN HIGH-FREQUENCY GENERATOR. H.Leboutet, G.Vincent and R.Warnecke.
C.R. Acad. Sci. (Paris), Vol. 246, No. 10, 1519-22 (March 10, 1958). In French.

Calculations on the performance of disk-loaded accelerator incorporating its own h.f. source (see preceding abstract) were made. For an h.f. power of 1 MW an energy of 4 MeV is obtained in an accelerator about 1.5 metres long. J.W.Sturgess

537.533

4060. THE THEORY OF ELECTRON MOTION IN CYCLIC ACCELERATORS IN PRESENCE OF RADIATION.
A.A.Kolomenskij and A.N.Lebedev.
Nuovo Cimento Suppl., Vol. 7, No. 1, 43-60 (1958).

The effects of the presence of radiation and of fluctuations in radiation on the vertical and radial oscillations in an axially symmetrical magnetic field are calculated. The calculations are also made for a race-track synchrotron. It is shown that radiation anti-damping of radial oscillations is important in a strong focusing accelerator. Methods of overcoming it are suggested.

J.W.Sturgess

537.533

4061. INITIAL PERFORMANCE OF THE TÔHOKU ELECTRON SYNCHROTRON AND THE VISIBLE RAYS CAUSED BY THE CIRCULATING ELECTRONS.
M.Kimura, T.Kitagaki, K.Shōda, N.Musturo, Y.Ōnuki and T.Tōhei.
Sci. Rep. Tôhuku Univ. First Ser. Vol. 40, No. 4, 233-43 (Jan., 1957).

This is a 40 MeV model constructed as a preliminary test for a larger machine. The electrons are maintained in a stable orbit (radius 25 cms) by 16 "C-magnets". Pole-face windings were used to correct eddy current effects in the poles. The radiation from the electrons was studied. Its angular distribution and intensity variation with energy were compared with Schwinger's theory (Abstr. 5460/1949). D.H.Lord

537.533

4062. ON THE MECHANISM OF CAPTURE OF ELECTRONS IN A BETATRON. Yu.S.Korobochko.
Zh. tekh. Fiz., Vol. 27. No. 4, 745-6 (1957). In Russian.

Analytical investigation of the perturbation arising from the space charge interaction (associated with the various streams of electrons circulating during the injection period) and the consequent loss of particles at the injection. G.Martelli

537.533.2 : 539.576

4063. THE STUDY OF FRESHLY DEFORMED METAL SURFACES WITH THE AID OF EXO-ELECTRON EMISSION. L.Grunberg.
Wear, Vol. 1, No. 2, 142-54 (Oct., 1957).

The emission of exo-electrons from metals is reviewed. Deformed metal surfaces produce counts in point-counters, counting tubes or electron-multipliers and this apparently spontaneous electron emission was at first ascribed to the latent heat developed during phase changes or interaction with oxygen. More recent investigations showed that the surface films on deformed metals contain special electronic energy levels associated with crystal imperfections in the oxide lattice. The energy levels can be excited thermally or optically, leading to electron emission at definite temperatures or wavelengths of light. The decay of emission depends on the atmosphere with which the metal surface is in contact. A.

537.533.2 : 538.245

4064. THE THEORY OF ELECTRON EMISSION FROM FERROMAGNETICS UNDER THE INFLUENCE OF AN ELECTROSTATIC FIELD. A.Z.Veksler.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 2, 222-7 (1957). In Russian.

On the basis of the s–d exchange model of a ferromagnetic it is shown that the electron emission produced by an applied electrostatic field depends on the square of the spontaneous magnetization. The theory agrees with experimental results from various sources. A.F.Brown

537.533.2 : 537.311.33

4065. FIELD EMISSION FROM SILICON. L.A.D'Asaro.
J. appl. Phys., Vol. 29, No. 1, 33-4 (Jan., 1958).

Field emission patterns were observed using a point made of a single crystal of p-type silicon. Stable patterns were obtained only after the point was distorted by heating in the presence of an electric field. The symmetry of the patterns agreed with the symmetry expected from the known orientation of the crystal. A.

537.533.3 : 537.534.3

4066. SCALING LAWS FOR SPACE CHARGE DYNAMICS. E.R.Harrison.
Brit. J. appl. Phys., Vol. 8, No. 10, 422-3 (Oct., 1957).

References are given which show that the scaling laws for dense beams of charged particles, published by Haine (Abstr. 7146/1957), have been well-known since 1931. A current example of their use in proton accelerator design is given. B.Meltzer

537.533.3

4067. TRANSVERSE INSTABILITY OF ELECTRON BEAMS. B.Epsztein.
C.R. Acad. Sci. (Paris), Vol. 246, No. 4, 586-8 (Jan. 27, 1958). In French.

Unstable transverse plasma oscillations may exist in electron beams in addition to the well-known longitudinal oscillations. These may constitute a new limitation to resolution in electron microscopy. A.E.I. Research Laboratory

537.533.3 : 537.534.3

4068. GRAPHICAL–ANALYTICAL CONSTRUCTION FOR THE TRAJECTORIES OF CHARGED PARTICLES IN ALTERNATING ELECTRIC AND STEADY MAGNETIC FIELDS. N.I.Shtepa.
Zh. tekh. Fiz., Vol. 28, No. 1, 178-87 (1958). In Russian.

A method is presented for finding the trajectory of a charged particle. Analytical expressions for the velocity are used in connection with a graphical step-by-step process. This involves certain errors, but these can be allowed for. An example is given of a proton moving in a steady magnetic field combined with an alternating electrostatic field of sinusoidal waveform. T.Mulvey

537.533.3

4069. THE FRESNEL BIPRISM IN ELECTRON OPTICS; INFLUENCE OF SOURCE SIZE; EFFECT OF AN ALTERNATING VOLTAGE APPLIED TO THE WIRE OF THE BIPRISM.
J.Faget, J.Ferré and C.Fert.
C.R. Acad. Sci. (Paris), Vol. 246, No. 9, 1404-7 (March 3, 1958). In French.

This is a short note extending previous work (see Abstr. 5377 1957) and directing attention to the points mentioned in the title

By varying the potential of the biprism, for example, it is possible to superimpose two sets of interference fringes. The resulting fringe system is similar to that obtained in light optics.
A.E.I. Research Laboratory

537.533.332

4070. USE OF A STRONG FOCUSING DOUBLET IN ELECTRON MICROSCOPY. A.Septier.
C.R. Acad. Sci. (Paris), Vol. 246, No. 13, 1983-5 (March 31, 1958). In French.
Two properly excited neighbouring quadrupole lenses are shown to be equivalent to a rotationally symmetric lens capable of being used for projection. Photographs taken in an electron microscope using such a system are presented.
A.E.I. Research Laboratory

537.533.35

4071. THE BOLT CATHODE AS AN OBJECT [HOLDER] IN AN ELECTRON EMISSION MICROSCOPE. E.B.Baş.
Z. angew. Math. Phys., Vol. 8, No. 3, 203-13 (1957). In German.
Experiments are reported on the use of the "bolt" cathode as an object-holder in an electron emission microscope. The bolt cathode consists of a cylindrical tungsten rod, the bolt, close pinched at one end, the top of the other free end being used as the emission surface. The bolt is surrounded by a tungsten helix, which can be heated by passing direct current. This helix serves as a primary cathode emitting electrons for electron bombardment of the bolt. When the bolt cathode is used as a specimen holder in an electron emission microscope the specimen is melted on the top of the tungsten bolt. Melting occurs by the bombardment of the specimen substances with accelerated electrons from an electron gun. This method has many advantages and is described in detail. Two properties of the bolt cathode, important for the emission microscope, i.e. axial displacement of the object and magnetic field of the heating helix, are discussed in detail. A micrograph shows the quality of the electron emission pictures obtained. A.

537.533.35

4072. PRELIMINARY EXPERIMENTS ON THE TIME-OF-FLIGHT β-SPECTROSCOPY. K.G.Malmfors and A.Nilsson.
Ark. Fys., Vol. 13, No. 3, Paper 22, 247-50 (1958).
The properties of a provisional time-of-flight spectrometer are investigated and compared with theory. The agreement is satisfactory. A.

537.533.35

4073. SOME CHARACTERISTICS OF AN IMPROVED VERSION OF THE IRON-JACKETED INTERMEDIATE-IMAGE BETA-RAY SPECTROMETER. L.Wegstedt.
Science Tools, Vol. 4, No. 2, 20-7 (Aug., 1957).
The author reports the results of an investigation of the resolution and transmission of a Siegbahn–Slätis intermediate-image beta-ray spectrometer. The effects of variations of source size and position, baffle opening, annulus width, and Geiger tube window diameter on the resolution and transmission are studied. The degree of non-linearity of the magnet (Bρ v. magnet current) was measured. A.

537.533.75 : 539.2

4074. NOTE ON COLLECTIVE ENERGY LOSSES IN METALS. T.Sato.
J. Phys. Soc. Japan, Vol. 12, No. 7, 832 (July, 1957).
The energy losses of fast electrons passing through thin films of transition and noble metals are interpreted on the basis of Pauling's valency scheme. It is suggested that it is the bonding electrons which contribute to plasma oscillation. The plasma energies, calculated on the assumption that these electrons are free, are then comparable with the observed energy losses. D.M.Edwards

537.533.8

4075. VARIATION OF SECONDARY EMISSION WITH PRIMARY ELECTRON ENERGY. B.K.Agarwal.
Proc. Phys. Soc., Vol. 71, Pt 5, 851-2 (May, 1958).
The following empirical formula for the variation of secondary yield with primary energy is proposed:

$$\delta/\delta_m = 2(E_o/E_{om})/\left[1 + (E_o/E_{om})^{1.85(2Z/A)}\right]$$

where Z = atomic number, A = atomic weight. Good agreement is obtained for Ge and MgO. A.H.W.Beck

537.533.9

4076. TRANSITION EFFECTS IN THE RADIATION OF FAST ELECTRONS. G.Breitling.
Z. Phys., Vol. 149, No. 2, 180-98 (1957). In German.
The theory of energy loss of electrons in material and its division into radiation, excitation and ionization is reviewed. This loss is measured for electrons of energy 3 to 15 MeV experimentally, by two different methods: ionization and fluorescence. For the latter case the experiments show, in agreement with the theory, a decrease, which becomes important with increasing energy, of the energy loss because of the polarization of the atoms and molecules.
G.E.Brown

537.534.75

4077. ON THE PENETRATION DEPTH OF MEDIUM-ENERGY IONS INTO SUBSTANCES. M.M.Bredov, I.G.Lang and N.M.Okuneva.
Zh. tekh. Fiz., Vol. 28, No. 2, 252-3 (1958). In Russian.
Calculations were carried out to explain the previously observed large penetration depths ($\sim 2 \times 10^{-5}$ cm) of 4 keV alkali-metal ions into Ge. Using a screened potential interaction and the Monte Carlo method of calculation, penetrations of $\sim 0.5 \times 10^{-5}$ cm were predicted; by adjusting the screening constant, agreement with experiment could be obtained. K.F.Hulme

DISCHARGE TUBES. IONIZATION. THERMIONICS

537.543 : 621.385.2

4078. ON THE KINETIC THEORY OF AN ELECTRON GAS IN THE PRESENCE OF BOUNDARIES. L.É.Pargamanik.
Zh. éksper. teor. Fiz., Vol. 33, No. 1(7), 251-5 (1957). In Russian.
The particular case of the kinetic equations of an electron gas in a plane diode is considered to demonstrate that a distribution function, satisfying prescribed conditions of emission and reflection from the electrodes, can be constructed in the one-dimensional case without taking account of the collision integral. Corrections to Langmuir's results were obtained which are important at small anode voltages. A.

537.543 : 621.385.2

4079. ABOUT SOME PRINCIPLES OF ELECTRON CURRENT IN VACUO. M.D.Khaskind.
Zh. tekh. Fiz., Vol. 28, No. 2, 424-8 (1958). In Russian.
The method of dimensions is used to derive a space-charge law for a cylindrical diode. It is more general than the Langmuir–Child law and consists of two terms containing $V_a^{1/2}$ and $V_a^{3/2}$ respectively (V_a is anode potential). Describes briefly an experimental proof of the law, performed with a cylindrical diode. Mentions a possible way of deriving similarly a law for plane-parallel electrodes. Discusses briefly the method of dimensions used for analysis of dependence of the saturation current on e, m_e, kT, work function and Planck's constant. J.M.Zarzycki

537.56 : 537.311.1

4080. BASIC MICROWAVE PROPERTIES OF HOT MAGNETO-PLASMAS. J.E.Drummond.
Phys. Rev., Vol. 110, No. 2, 293-306 (April 15, 1958).
The usual conductivity tensor of a uniform plasma in a uniform plasma in a uniform, static magnetic field (along the z axis) is generalized to include four effects of random motion of plasma electrons. These effects are due to (1) the shape of the radio-frequency electric field strength expressed by $\nabla \times \nabla \times E \neq 0$, (2) the partial spanning of a wavelength by an electron cyclotron orbit, and (3) the possible variation of the radio-frequency electric field lines along the z axis of electron drift. The effects resulting cause diffusion damping, the existence of nonzero (x,z), (y,z), (z,x) and (z,y) elements in the conductivity tensor, large changes of the effective plasma density, and phase changes in the conduction current density. These results are applied to evaluation of the index of refraction of microwave signals propagating normal to the magnetic field. The existence of unusual transmission bands is predicted for very dense, hot plasmas. A.

537.56

4081. CYCLOTRON RESONANCE IN A PLASMA. É.A.Kaner.
Zh. éksper. teor. Fiz., Vol. 33, No. 2(8), 544-6 (1957). In Russian.
The physical mechanism of cyclotron resonance in metals suggests that a similar effect will exist in an electron–ion plasma.

In fact the same theory may be used with the difference that the equilibrium distribution of electrons is Maxwellian and not Fermi. Calculations of the high-frequency impedance of a plasma are made and it is shown that at resonance there is absorption of electromagnetic waves. Experiments should yield information about relaxation times in the plasma. W.Bardsley

537.56 : 535.338.334

BROADENING OF SPECTRAL LINES IN PLASMA. See Abstr. 3856

537.562

4082. ELECTRON COLLECTION AND ELECTRON SHEATH. T.Okuda and K.Yamamoto.
J. Phys. Soc. Japan, Vol. 13, No. 1, 112 (Jan., 1958).

Gives measured and calculated values of the "electron" sheath formed round a positive probe for argon at pressures varying from 0.003 to 1 mm Hg. Current/probe-voltage relations and sheath-radius/positive-probe-voltage curves are also given. J.D.Craggs

537.562 : 536.461

ION IDENTIFICATION IN FLAMES. See Abstr. 3942

537.564 : 535.215.9

4083. MASS-SPECTROSCOPIC INVESTIGATION OF THE PHOTO-IONIZATION IN GASES. E.Schönheit.
Z. Phys., Vol. 149, No. 2, 153-79 (1957). In German.

An experimental arrangement for the mass-spectrographic analysis of the ions formed when light from a vacuum spark passes through a gas is described in detail. Results are given for air, N_2, O_2, A, water vapour, Hg vapour and "illuminating gas". The results are discussed in terms of photoionization and photodissociation, it being shown for example that under given conditions N_2 is less dissociated than O_2. The effects of first passing the radiation through a lithium fluoride filter were also investigated. The work is well related to earlier investigations, there being 88 references. J.Dutton

537.564

4084. MASS SPECTROSCOPIC DETERMINATION OF PHOTOIONIZATION PRODUCTS. R.F.Herzog and F.F.Marmo.
J. chem. Phys., Vol. 27, No. 5, 1202-5 (Nov., 1957).

A radiofrequency mass spectrometer of the Bennett type was utilized to measure the mass of ions formed by photoionization of several gases by the ultraviolet radiation of a hydrogen discharge. Investigations were performed up to 11.4 eV, the LiF cutoff. The mass spectra were found to be very simple and usually consisted of only one peak representing the mass of the whole molecule. This was found to be true for acetone, butadiene, butene, carbon disulphide, methyl-ethyl ketone, nitric oxide, propylene, and toluene. Only in the case of butane, ethyl acetate, and isopropyl alcohol, fragment ions were found. Some of them are even more intense than the parent ions. Undesirable "secondary spectra", reported by Lossing and Tanaka, can be avoided by grounding of the lithium fluoride window. A.

537.564

4085. PHOTON IMPACT STUDIES OF MOLECULES USING A MASS SPECTROMETER.
H.Hurzeler, M.G.Inghram and J.D.Morrison.
J. chem. Phys., Vol. 28, No. 1, 76-82 (Jan., 1958).

A vacuum ultraviolet monochromator was combined with a mass spectrometer, in order to study photoionization processes. A detailed description is given of this instrument. Photoionization efficiency curves for parent and fragment ions from a number of molecules were measured, using a photon beam with an energy spread of 0.05 eV. It is shown how the results can be interpreted in terms of potential surfaces and electronic transition probabilities. In favourable cases vibrational structure may be resolved. A.

537.564

4086. IONIZATION AND DISSOCIATION OF OXYGEN DIFLUORIDE BY ELECTRON IMPACT.
V.H.Dibeler, R.M.Reese and J.L.Franklin.
J. chem. Phys., Vol. 27, No. 6, 1296-7 (Dec., 1957).

The mass spectrum of OF_2 includes the ions OF_2^+, OF^+, O^+, and F^-. The ionization potential of the molecule and appearance potentials and excess kinetic energy were measured for the OF^+ and F^- ions. The known heat of formation of OF_2 and the appearance potential of the F^- ion permit calculation of the bond dissociation energies D(FO—F) and D(O—F) and an estimate of the ionization potential I(OF). Dissociation energies estimated for the OF_2^+ ion are consistent with those of the neutral molecule. A.

537.564

4087. DISSOCIATION OF CO^+ AND CO^{++} IONS BY COLLISION WITH NEUTRAL MOLECULES. C.E.Melton and G.F.Wells.
J. chem. Phys., Vol. 27, No. 5, 1132-41 (Nov., 1957).

The dissociations were investigated with a mass spectrometer. CO^+ dissociates into C^+ and O, or C and O^+, depending upon the energy of the parent ion. The predominant ion resulting from dissociation of CO^{++} is C^+ suggesting a charge-exchange dissociation reaction. This is supported by the observation that neutral molecule having high ionization-potentials such as He and Ne do not produce dissociation in CO^{++}. Energy for the dissociation of CO^{++} is derived from the electronic energy of the molecular ion rather than from kinetic energy. A.

537.564 : 551.574.7

4088. IONIZATION OF RADIOACTIVE PARTICLES IN THE FREE AIR. S.M.Greenfield.
J. geophys. Res., Vol. 61, No. 1, 27-33 (March, 1956).

In order to evaluate the possible role of radioactive particles from an atomic cloud as condensation nuclei, an analysis was made to determine their degree of ionization. Individual radioactive particles become ionized due to β emission, and an estimate of the half-life of these ions has been made for various times in the life history of an atomic cloud. It is concluded that while there is a transient charge on these particles, its half-life is small compared with the disintegration rate, with the result that for all practical purposes radioactive particles in the free air are not necessarily preferred condensation nuclei. A.

537.564

4089. ON THE CAPTURE CROSS-SECTION FOR ELECTRONS. V.S.Nikolaev.
Zh. éksper. teor. Fiz., Vol. 33, No. 2(8), 534-5 (1957). In Russian.

Formulae for cross-section for transfer of electrons between fast moving ions and surrounding gas atoms are given for a number of ranges of ion velocity and for several gases. These formulae agree better with the experimental results than do the classically-based formulae of Gluckstern (Abstr. 7158/1955). The proofs of these formulae are not given. G.Martelli

537.564

4090. CHARGE-EXCHANGE CROSS-SECTIONS OF NITROGEN IONS IN GASES.
V.S.Nikolaev, L.N.Fateeva, I.S.Dmitriev and Ya.A.Teplova.
Zh. éksper. teor. Fiz., Vol. 33, No. 1(7), 306-7 (1957). In Russian.

The cross-sections were measured for the capture and loss of electrons by N^{+2}, N^{+3}, and N^{+4}, with energies between 1.3 and 9.7 MeV, in nitrogen, argon and hydrogen. Magnetic analysis was used. The capture cross-section results agree well with the theory of Nikolaev (see preceding abstract). W.O.Lock

537.565

4091. ELECTRON MOBILITY IN BORON TRIMETHYL.
G.A.Ferguson, Jr and F.E.Jablonski.
Rev. sci. Instrum., Vol. 28, No. 11, 893-6 (Nov., 1957).

Boron trimethyl counters have operated successfully as neutron sensitive proportional counters. Differential pulse-height spectra for these counters show good resolution. The electron mobility in boron trimethyl is measured by the method of Nicholson in the X/P region from 0.8 to 7.0 V/cm per mm Hg. The data indicate a constant mobility above X/P = 2.5 V/cm per mm Hg, but the mobility increases rapidly for lower values. A.

537.568

4092. AFTERGLOW OF PURE AND MIXED GASES. S.Takeda.
J. Phys. Soc. Japan, Vol. 13, No. 1, 113-14 (Jan., 1958).

Gives comprehensive data on microwave deionization measurements in argon and argon—hydrogen mixtures (pressure = 10 mm Hg) for different exciting pulse lengths (17-48 μsec). The results are very briefly discussed. J.D.Craggs

537.581 : 621.385.032.213.13

4093. THERMIONIC EMISSION FROM BARIUM ACTIVATED MOLYBDENUM. E.S.Rittner and R.H.Ahlert.
J. appl. Phys., Vol. 29, No. 1, 61-3 (Jan., 1958).

Measurements are presented of (a) the emission density from clean and oxygen-covered Mo surfaces as a function of the arrival rate of Ba or of Ba + BaO; and of (b) the migration length of Ba and of Ba + BaO over oxygen-covered Mo surfaces. The emission density is comparable to that obtained from similarly activated tungsten surfaces, but the minimum arrival rate of total barium required for complete surface coverage is much higher than for the tungsten case. The migration length is also comparable for the two systems. A.

537.583 : 536.461

4094. THERMAL EMISSION OF ELECTRONS FROM CARBON PARTICLES. A.A.Arshinov and A.K.Musin.
Dokl. Akad. Nauk SSSR, Vol. 118, No. 3, 461-3 (1958). In Russian.

Derives formulae for the calculation of concentration of electrons in carbon flames. The derivation is based on the Richardson—Dushman equation, taking into account recombination of electrons with positvely charged carbon particles. Electron work function of 6.8 eV was calculated for carbon particles at temperatures between 3100 and 3300°K, using above formulae and the experimental values of electron concentrations in acetylene—oxygen flames given by Shuler and Weber (Abstr. 4651/1954). It is shown that the observed concentrations are due to carbon particles of radius of the order of 10^{-6} cm. J.M.Zarzycki

537.583 : 539.18

DETERMINATION OF THE ELECTRON AFFINITY ENERGY BY THE METHOD OF SURFACE IONIZATION. See Abstr. 3406

537.583 : 539.217

THE USE OF POSITIVE-ION EMISSION FOR THE DETERMINATION OF DIFFUSION CONSTANTS IN SOLID BODIES. See Abstr. 3475

COSMIC RAYS

537.591

4095. THE "SABBIONE" COSMIC RAY LABORATORY.
E.Fiorini, C.Giori, C.Succi and C.Moriggia.
Nuovo Cimento Suppl., Vol. 7, No. 1, 129-38 (1958). In Italian.

Gives details of the design and facilities of a laboratory which has been built at 2518 m above sea-level, (46.5°N, 04°W), near the Morasco—Sabbione funicular. P.Rothwell

537.591

4096. STARS AS SOURCES OF COSMIC RAYS. H.Babcock.
Phys. Rev., Vol. 109, No. 6, 2210-11 (March 15, 1958).

It is suggested that many stars have irregularly fluctuating magnetic fields of some magnitude resulting from turbulent motion of stellar material in the presence of rotation and may be important sources of cosmic rays. The fluctuations cause induction processes and hydromagnetic shock waves which excite ions to high energies. J.W.Sturgess

537.591.1

4097. THE PROTON COMPONENT OF COSMIC RAYS AT SEA LEVEL. A.G.Meshkovskii and L.I.Sokolov.
Zh. éksper. teor. Fiz., Vol. 33, No. 2(8), 542-4 (1957). In Russian.

Using a technique described in another paper (Abstr. 8268/1956) the spectrum of cosmic ray protons was measured in the momentum range from 0.31 to 0.55 GeV/c. The values of the intensities are compared with those obtained with the same apparatus at 3250 m above sea level, and the mean free path for absorption in air is thus deduced ($L = 143.5 \pm 6.1$ g/cm^2). This value is in good agreement with that obtained by other authors. A comparison with results obtained at sea level for protons with momenta larger than 0.5 GeV/c shows that the maximum of the spectrum lies between 0.5 and 0.6 GeV/c. G.Martelli

537.591.15

4098. A STUDY OF EXTENSIVE AIR SHOWERS OF THE COSMIC RADIATION. O.Dovzhenko, V.Zatsepin, E.Murzina, S.Nikol'skii, I.Rakobol'skaya and E.Tukish.
Dokl. Akad. Nauk SSSR, Vol. 118, No. 5, 899-902 (1958). In Russian.

Detailed results are presented of a study of the energy characteristics of extensive showers using large counter arrays at 3860 m above sea-level in conjunction with (a) counter arrays vertically below at depths of 800 and 1600 g/cm^2 of water equivalent, and (b) a multiplate cloud chamber and ionization chamber assemblies. With arrangement (a), it was found (1) the energy spectrum of μ-mesons at a distance of ≤ 10 m from the shower axis followed $E^{-0.27\pm0.06}$ law for energies $1.5 \leq E \leq 3.5$ GeV, and (2) the cross-section of the core of showers with primary energy > greater than 6×10^{14} eV was 1-2 m. With arrangement (b) it was found the π^0-mesons of energy $\leq 10^{10}$ eV made a significant contribution to the electron—photon cascade. The distribution of energy between the hard and soft components was determined as a function of distance from the shower axis. W.O.Lock

537.591.15

4099. ON INTERPRETATION OF THE SPATIAL DISTRIBUTION OF NUCLEAR-ACTIVE PARTICLES IN EXTENSIVE AIR SHOWERS. Yu.N.Vavilov.
Zh. éksper. teor. Fiz., Vol. 33, No. 1(7), 179-82 (1957). In Russian.

Experimental data referring to the shape of the spatial distribution curve of nuclear-active particles near the axis of extensive showers are considered. The data indicate a small value of the averaged minimal angles of emission of nuclear-active particles responsible for generation of the nuclear-active particles directly recorded in the experiments ($< 3\text{-}4 \times 10^{-3}$ radians). It is shown that Landau's theory of multiple production of particles can yield such a small value for the emission angle only if it simultaneously predicts a high degree of concentration of energy of the incident particle on a single secondary particle in an elementary act of the nuclear-cascade process at energies of 10^{13}—10^{15} eV. A.

537.591.15

4100. ANALYSIS OF THE PROPERTIES OF THE ELECTRON—PHOTON COMPONENT OF EXTENSIVE ATMOSPHERIC SHOWERS IN THE LOWER THIRD OF THE ATMOSPHERE. V.I.Zatsepin.
Zh. éksper. teor. Fiz., Vol. 33, No. 1(7), 190-6 (1957). In Russian.

From an analysis of experimental data it is concluded that in the absence of large fluctuations in the longitudinal development of broad atmospheric showers the energy spectrum in the region $E \geq 10^9$ eV and in the lower third of the atmosphere satisfies the condition $1.3 \geq s \geq 1.2$ (if electrons in equilibrium with μ-mesons are subtracted), where s is the parameter of the electromagnetic cascade theory which characterizes the electron energy spectrum. For a spectrum of the indicated type the spatial distribution of electrons at distances of from 1.5 to 250 m from the shower axis can be explained completely by multiple Coulomb scattering. A.

537.591.15

4101. HYDRODYNAMICAL INTERPRETATION OF A CHARACTERISTIC OF EXTENSIVE COSMIC RAY SHOWERS RECORDED IN PHOTOGRAPHIC EMULSIONS.
G.A.Milekhin and I.L.Rozental'.
Zh. éksper. teor. Fiz., Vol. 33, No. 1(7), 197-9 (1957). In Russian.

The experimental distribution of the transverse momentum components of secondary particles is compared with the predictions of the hydrodynamical theory of multiple particle production. It is found that the predictions of the one-dimensional theory for a final temperature of $T = mc^2/k$ (m is the π-meson mass) agrees satisfactorily with the experimental data. This permits one to draw conclusions concerning the nature of π—π interaction. A.

537.591.15

4102. ON THE ANGULAR DISTRIBUTION FUNCTION OF PARTICLES IN THE MAXIMUM OF A CASCADE SHOWER.
I.P.Ivanenko.
Zh. éksper. teor. Fiz., Vol. 33, No. 3(9), 825-7 (1957). In Russian.

Formulae of Belen'kii (1948) giving the distribution of particles in the maximum of a cosmic-ray shower as a function of energies and angles, are re-calculated without the restrictive assumption that, to account for the low-angle scattering, scattering should be considered to be plural. Solutions of the diffusion equations are found in the form of Legendre polynomials and the values of $\overline{\cos^2\theta}$ (E) are found. G.Martelli

537.591.15 : 523.75

4103. LARGE INCREASE OF COSMIC-RAY INTENSITY FOLLOWING SOLAR FLARE ON FEBRUARY 23, 1956. S.E.Forbush.
J. geophys. Res., Vol. 61, No. 1, 155-6 (March, 1956); Vol. 62, No. 1, 169-70 (March, 1957).

537.591.15 : 523.75

4104. COSMIC-RAY INTENSITY AT HIGH ALTITUDES ON FEBRUARY 23, 1956. J.A.Van Allen and C.E.McIlwain.
J. geophys. Res., Vol. 61, No. 3, 569-71 (Sept., 1956).

537.591.15 : 523.75

4105. THE SUPERPOSITION OF COSMIC-RAY EFFECTS ON FEBRUARY 23, 1956. R.R.Brown.
J. geophys. Res., Vol. 62, No. 1, 147-54 (March, 1957).

The cosmic ray event of 23 February 1956 represents the superposition of a flare increase and a broad Forbush-type intensity decrease. A model is proposed to account for the cosmic ray intensity observations during this event. A.

537.591.15 : 539.12

ENERGY SPECTRUM OF CASCADE ELECTRONS IN LIGHT SUBSTANCES. See Abstr. 3288

537.591.2

4106. THE ABSOLUTE INTENSITIES OF COSMIC RAYS AT 2840 METERS AND GEOMAGNETIC LATITUDE 25°N.
M.Murakami and T.Maeda.
J. Phys. Soc. Japan, Vol. 12, No. 5, 557 (May, 1957).

Intensities of the total, hard and soft components of cosmic rays are given as 2.07 ± 0.02, 1.17 ± 0.01 and 0.90 ± 0.02, $\times 10^{-2}$ cm^{-2} sec^{-1} sterad^{-1} respectively, using the technique of measurement reported by Kitamura and Minakawa (Abstr. 6715/1954). The zenith angle distribution of intensities between 0° and 45° is given by $\cos^{7.1}\theta$ and $\cos^{3.1}\theta$ for the hard and soft components respectively. The ratios of intensities at 2840 m and sea level, at different zenith angles, for the total, hard and soft components are also reported. P.Rothwell

537.591.2

4107. ENERGY SPECTRUM OF COSMIC RADIATION.
H.Alfvén and E.Åström.
Nature (London), Vol. 181, 330-1 (Feb. 1, 1958).

The spectrum is fitted by considering an "energy pump", the speed of which is a power function of the momentum of the particles. E.J.Burge

537.591.5

4108. COSMIC-RAY INTENSITY VARIATIONS AT SEA LEVEL DURING MAGNETIC-STORM PERIODS.
G.Ramaswamy and S.D.Chatterjee.
Canad. J. Phys., Vol. 36, No. 5, 635-7 (May, 1958).

The results of continuous observations made between 6 February 1957 and 15 May 1957 are compared with the incidence of magnetic storms. Simultaneous decreases of cosmic-ray intensity appear to be found. E.J.Burge

537.591.5

4109. COSMIC RAYS AND THE SUNSPOT CYCLE. A LARGE COSMIC-RAY DECREASE ACCOMPANYING THE SOLAR MAXIMUM OF 1957. J.R.Winckler and L.Peterson.
Nature (London), Vol. 181, 1317-19 (May 10, 1958).

Measurements with a Geiger counter and ionization chamber during balloon flights in June 1957 at latitudes between 51.2° N and 58.6° N gave, for high altitudes, values as low as about half of those of August 1955. The mean energy per particle was higher in 1957. Values obtained during 1956 are also given. E.J.Burge

537.591.5

4110. COSMIC RAYS AND THE SUNSPOT CYCLE. PRIMARY α-PARTICLE INTENSITY AT SUNSPOT MAXIMUM.
P.S.Freier, E.P.Ney and P.H.Fowler.
Nature (London), Vol. 181, 1319-21 (May 10, 1958).

Emulsion stacks were exposed during the balloon flights (see preceding abstract). The total vertical flux in June 1957 was 157 ± 17 peters (particles. m^{-2}. sec^{-1}. sterad^{-1}), only 55% of the 1954 and 1956 values. No sharp low-energy cut-off was found, and both the lower and higher energy flux were reduced. Proposed modulation mechanisms are discussed. E.J.Burge

537.591.5

4111. RAPID DECREASE OF COSMIC-RAY INTENSITY.
R.A.R.Palmeira and R.W.Williams.
Nuovo Cimento, Vol. 8, No. 2, 352-5 (April 16, 1958).

A sudden decrease in cosmic-ray μ-meson counting-rate, associated with the magnetic storm and auroral display of 10 February 1958, was recorded on a high counting-rate, high time-resolution meson monitor, composed of large disks of plastic scintillator. In this event, which resembled a Forbush decrease except that the time-scales were shorter, the cosmic ray intensity dropped by 2.1% in about 1 h, remained at that level for a few hours, and then gradually rose to its original value, in a total time of about 14 h. Since the median energy of the primaries of the mesons recorded is about 10 GeV, a lower limit of 5×10^{-5} G for the magnetic field of the solar gas cloud, which excluded a fraction of cosmic rays from the earth, may be deduced from these results. P.Rothwell

537.591.5

4112. CHANGES IN AMPLITUDE OF THE 27-DAY VARIATION IN COSMIC RAY INTENSITY DURING THE SOLAR CYCLE OF ACTIVITY. D.Venkatesan.
Tellus, Vol. 10, No. 1, 117-26 (Feb., 1958).

The 27-day recurrence tendency in the cosmic ray intensity was studied by the Chree method (1913) of analysis for the period 1937-55, using the ionization chamber records at Huancayo. The amplitude of the 27-day variation changes from year to year. The variation in the amplitude is in general agreement with the changes in solar activity as revealed by the sun-spot number only for the years 1937-46 and 1952-55. This is in agreement with the results of Meyer and Simpson for the same periods, obtained from a slightly different method of analysis. The correlation breaks down for the period 1946-52, and this is discussed in terms of possible changes in the electromagnetic conditions in the interplanetary space during the solar cycle. A.

537.591.5 : 523.75

4113. ON THE INCREASE IN COSMIC RAY INTENSITY AND THE ELECTROMAGNETIC STATE IN INTERPLANETARY SPACE DURING THE SOLAR FLARE OF FEB. 23, 1956. D.Eckhartt.
Tellus, Vol. 10, No. 1, 126-36 (Feb., 1958).

The solar flare increase of cosmic ray intensity observed at various ionization chamber stations was studied. The orbits of the flare cosmic-ray particles was corrected for their deflection in the geomagnetic field. A detailed discussion of the different onset times of the solar flare increase registered at these stations is given. These differences in onset times serve as a means to study the electromagnetic state in interplanetary space during the cosmic ray outburst. Special attention is paid to those stations which observed the earliest onset times. For one of these, Hobart, it can definitely be shown that cosmic ray particles of momenta up to around 40 GeV/c did not arrive from the direction of the sun. The station did not lie inside one of Firor's impact zones at the beginning of the solar flare. This shows the existence of deflecting magnetic fields between the sun and the earth. It appears from this investigation that the cosmic ray particles which caused the earliest onset times had come from directions towards a solar beam which — according to Alfven's beam model (1950) — would be expected to produce the large magnetic storm observed two days after the flare. A probable mechanism of trapping and guiding the flare low energy cosmic ray particles by such a beam is also discussed. A.

537.591.8 : 539.17

INTERACTION OF COSMIC-RAY PROTONS WITH LEAD NUCLEI. See Abstr. 3367

537.591.8 : 539.17

INTERACTIONS OF COSMIC-RAY NUCLEONS WITH NUCLEI. See Abstr. 3376

MAGNETISM

538.082

4114. TEMPERATURE-REGULATED BISMUTH RESISTOR FOR MAGNETIC-FIELD MEASUREMENTS.
C.G.Dols, E.W.Skiff and P.G.Watson.
Rev. sci. Instrum., Vol. 29, No. 5, 349-54 (May, 1958).

The magnetoresistance effect of the metal bismuth has been used in measuring magnetic induction for many years. This paper describes significant features of the electrical and mechanical design of an electrically temperature-regulated resistor assembly and associated equipment. Commercial ductile bismuth wire was successfully used in a small probe. Useful resolution of 2 gauss in fields above 5000 gauss was readily attained. Limitations and advantages of bismuth resistors as devices for measuring magnetic induction are discussed briefly. Some data from the use of the first units are presented. A.

538.082 : 541.133.08 : 621.317.41

METHOD FOR THE MEASUREMENT OF MAGNETIC SUSCEPTIBILITY. See Abstr. 3541

538.113/.114 : 537.311.33

MAGNETIC SUSCEPTIBILITY OF MOTT EXCITONS IN SEMICONDUCTORS. See Abstr. 3998

538.113

4115. CONTRIBUTION TO THE PHENOMENOLOGICAL THEORY OF PARAMAGNETIC RELAXATION IN PARALLEL FIELDS. N.K.Belousova and I.G.Shaposhnikov.
Zh. éksper. teor. Fiz., Vol. 33, No. 1(7), 237-42 (1957). In Russian.

The role of spin—lattice interaction in the phenomenological theory of complex paramagnetic susceptibility for parallel fields is taken into account to a greater extent than previously. A

538.113

4116. THE INTERPRETATION OF TEMPERATURE-INDEPENDENT PARAMAGNETISM. J.Guy, J.Tillieu and J.Baudet.
C.R. Acad. Sci. (Paris), Vol. 246, No. 4, 574-6 (Jan. 27, 1958).
In French.

It is shown by a variational method that the modulus of the

Langevin diamagnetic susceptibility of molecules is greater than or equal to the Van Vleck paramagnetism, in disagreement with some experimental results. E.P.Wohlfarth

538.114

4117. ON THE THEORY OF THE g-FACTOR IN FERROMAGNETIC METALS. E.A.Turov.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 1, 183-4 (1957).
In Russian.

A formula for the internal field (H_i) is calculated on the basis of the s–d exchange model of a ferromagnetic due to Vonsovskiĭ and Turov (Abstr. 10634/1954). Comparison with the formula for H_i obtained by Kittel and Mitchell (Abstr. 5206/1956) shows fundamental disagreement, the reason for which is not yet clear.
A.F.Brown

538.114

4118. THE REMANENT MAGNETIZATION OF SINGLE DOMAIN FERROMAGNETIC PARTICLES. II. MIXED UNIAXIAL AND CUBIC ANISOTROPIES. D.G.Tonge and E.P.Wohlfarth.
Phil. Mag. (Eighth Ser.), Vol. 3, 536-7 (May, 1958).

A continuation of previous work (Abstr. 1134/1958); it is shown that the reduced remanence of random particles only differs appreciably from $\frac{1}{2}$ if the ratio of the uniaxial to the cubic anisotropy coefficients is less than a constant of order 1. E.P.Wohlfarth

538.114

4119. SPIN WAVES. J.Van Kranendonk and J.H.Van Vleck.
Rev. mod. Phys., Vol. 30, No. 1, 1-23 (Jan., 1958).

A review discussing spin deviations, the harmonic oscillator approximation for ferromagnetism, results for magnetization and specific heat, the effect of dipolar coupling, ferromagnetic resonance, antiferromagnetism and ferrimagnetism, spin relaxation processes, and the validity of the model. E.P.Wohlfarth

538.114

4120. ON THE THEORY OF ANTIFERROMAGNETISM. II. A.Ts. Amatuni.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 1, 17-27 (1957).
In Russian.

The methods of Pt I (ibid., Vol. 3, 411, 1956) are used to derive formulae for the magnetization and magnetic susceptibility of an anisotropic antiferromagnetic at temperatures less than the Néel temperature. Good agreement with the experimental results of van den Handel et al. (Abstr. 2538/1953) on single crystals of $CuCl_2.2H_2O$ was obtained. A.F.Brown

538.114

4121. ON THE THEORY OF ANTIFERROMAGNETISM. V.M.Tsukernik.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 3, 566-7 (1957).
In Russian.

In a ferromagnetic, equilibrium is achieved by interaction of spin waves with each other. In an antiferromagnetic, on the other hand, the basic process is shown to be the interaction of spin waves and lattice waves. A.F.Brown

538.122

4122. A METHOD FOR DETERMINING THE MAGNETIC MEDIAN SURFACE IN THE INTERFERENCE OF A MAGNET WITH A CONSTANT MAGNETIC FIELD. C.Canarutto.
Elettrotecnica, Vol. 44, No. 8, 449-50 (Aug. 10-25, 1957).
In Italian.

The mathematical background to the method is described, and the precision of the method is discussed. The aim is to find those points where the radial component of the magnetic field is zero. Limitations of the method are discussed (for related work see Abstr. 4483/1956). The problem treated arises in the study of particle accelerators such as betatrons and synchrotrons.
L.S.Goddard

538.122 : 550.38

4123. ARC-LENGTHS ALONG THE LINES OF FORCE OF A MAGNETIC DIPOLE. S.Chapman and M.Sugiura.
J. geophys. Res., Vol. 61, No. 3, 485-8 (Sept., 1956).

Formulae and tables for the arc-length along the lines of force of a magnetic dipole are given with reference to the earth treated as a sphere. These tables may prove useful in connection with the study of radio whistlers and of the motion of charged particles along the lines of geomagnetic force. A.

538.2 : 550.34 : 534.2

THE INTERACTION BETWEEN ELASTIC WAVE MOTIONS AND A MAGNETIC FIELD IN ELECTRICAL CONDUCTORS. See Abstr. 3799

538.22 : 537.311.33

MAGNETIC PROPERTIES OF THE INTERMETALLIC COMPOUND, CdSb. See Abstr. 4007

538.221

4124. CALCULATION, FROM MAGNETOSTRICTION DATA, OF THE MAGNITUDE OF CHANGE OF THE CURIE TEMPERATURE WITH PRESSURE. K.P.Belov and I.K.Panina.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 1, 185-6 (1957).
In Russian.

A formula is derived relating the change of the Curie temperature with pressure ($\Delta\theta/\Delta p$) to the magnetostriction constant and thermodynamic coefficients. Agreement with published experimental values of $\Delta\theta/\Delta p$ is good for Ni–Fe–Co alloys, but poor for a Ni–Cu alloy. A.F.Brown

538.221 : 538.632

4125. SPIN–ORBIT COUPLING AND THE EXTRAORDINARY HALL EFFECT. C.Strachan and A.M.Murray.
Nature (London), Vol. 181, 1260 (May 3, 1958).

The outline of a quantum-mechanical treatment is given which shows that spin–orbit coupling can account for the fact that the Hall effect in ferromagnetics varies as the square of the resistivity and is temperature dependent. K.W.Plessner

538.221 : 538.614

4126. DIRECT OBSERVATION OF WEISS DOMAINS BY MEANS OF THE FARADAY EFFECT C.Kooy.
Philips tech. Rev., Vol. 19, No. 10, 286-9 (1957-58).

During the preparation of single crystals of $BaFe_{12}O_{19}$, the main constituent of ferroxdure, single crystal platelets less than 1 μ thick are obtained under certain conditions. The hexagonal axis lies perpendicular to the surface of the platelets, which, moreover, are transparent to red light. Since the magnetization of the Weiss domains is parallel to the hexagonal axis (and alternately in opposite directions in adjacent domains), a Faraday effect is observed with transmitted light. This effect makes the Weiss domains immediately visible when such a crystal is viewed through a polarizing microscope with nicols not quite exactly crossed. A number of photos are reproduced showing the patterns so obtained in both virgin and magnetized platelets. Conclusions can be drawn from the photos regarding the distribution and size of the Weiss domains. A.

538.221 : 539.215.4

4127. ON THE DEPENDENCE OF THE COERCIVE FORCE OF COBALT AND COBALT–CHROMIUM ALLOY POWDERS ON THE PARTICLE SIZE. G.S.Kandaurova.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 3, 548-50 (1957).
In Russian.

The coercivity (H_C) of cobalt and cobalt + 9.6% chromium powders was measured as a function of particle size in the range 0-1300 microns. Results are shown in graphs which also show the effect on H_C of heating the powders to 600°C. In general H_C rises as the particle size falls, but a more complex behaviour is observed with particles of diameter $< 40\mu$. A.F.Brown

538.221 : 539.12

4128. EXPERIMENTAL STUDY OF THE KINETICS OF THE MAGNETIC MOMENTS OF IRON ABOVE THE CURIE POINT. M.Ericson and B.Jacrot.
C.R. Acad. Sci. (Paris), Vol. 246, No. 7, 1018-20 (Feb. 17, 1958).
In French.

Reports results of experiments on the inelastic scattering of slow neutrons, giving a fluctuation of the magnetization in agreement with the predictions of the Heisenberg model.
E.P.Wohlfarth

538.221 : 621.318.2

4129. THE HIGH TEMPERATURE STABILITY OF PERMANENT MAGNETS OF THE IRON–NICKEL–ALUMINIUM SYSTEM. A.G.Clegg and M.McCaig.
Brit. J. appl. Phys., Vol. 9, No. 5, 194-9 (May, 1958).

The open circuit magnetization of rectangular bars of various modern permanent magnet alloys was measured at temperatures up to 550°C. A differential ballistic method was used and, after magnetization at room temperature, both reversible and irreversible losses occur on heating. These losses vary with material and dimension ratio, and in an attempt to explain these variations demagnetization curves at 500°C were measured. To avoid the irreversible losses, stabilization at a higher temperature is better than ageing in an alternating field. A.

538.221

4130. EFFECT OF HEAT TREATMENTS ON THE MAGNETIC PROPERTIES OF THE $FeTiO_3$—Fe_2O_3 SOLID SOLUTION SERIES.
Y.Ishikawa and S.Akimoto.
J. Phys. Soc. Japan, Vol. 12, No. 7, 834-5 (July, 1957).

Describes the effect of heat treatments on the intensity of magnetization of $0.5\,FeTiO_3$—$0.5\,Fe_2O_3$. The intensity of magnetization changes rapidly with the temperature of heat treatment when the specimen is cooled slowly, the maximum intensity of magnetization corresponding to a temperature of about 1050°C. It is suggested that the strong ferromagnetism is acquired on cooling through the order-disorder transformation temperature only when some short-range order has been created by heat treatment at the higher temperature. A.E.De Barr

538.221 : 537.311 : 537.226.2

THE DIELECTRIC BEHAVIOUR OF MAGNESIUM MANGANESE FERRITE. See Abstr. 3973

538.221 : 538.665

4131. THE MAGNETOCALORIC EFFECT OF MnAs.
A.J.P.Meyer and P.Taglang.
C.R. Acad. Sci. (Paris), Vol. 246, No. 12, 1820-2 (March 24, 1958).
In French.

The curve relating ΔT with temperature shows a sharp minimum at 35°C, followed by a change in sign to positive values, and a further sudden decrease at 126°C back to negative values. The first temperature corresponds to a polymorphic transition from ferro- to antiferromagnetism, the second to the Néel point. E.P.Wohlfarth

538.221

4132. MAGNETIC RESONANCE OF $MnAu_2$.
G.Asch and A.J.P.Meyer.
C.R. Acad. Sci. (Paris), Vol. 246, No. 8, 1180-2 (Feb. 24, 1958).
In French.

Reports results of measurements between 17° and 140°C, in fields up to 2×10^4 oersted and at frequencies 9.30 and 35.63 kMc/s. An absorption maximum which shifts to higher fields as the temperature rises to 90°C was observed at the higher frequency; at higher temperatures the maximum position is steady at 1.27×10^4 oersted. The results are explained in terms of field-dependent magnetic transitions. E.P.Wohlfarth

538.221

4133. TIME DEPENDENT CONSTRICTED HYSTERESIS LOOPS IN A SINGLE CRYSTAL OF MANGANESE FERROUS FERRITE.
U.Enz.
Physica, Vol. 24, No. 1, 68-70 (Jan., 1958).

The time-dependent permeability decrease after a.c. demagnetization is strongly dependent on temperature as a result of the blocking of domain wall motion; this also causes hysteresis loop constrictions. E.P.Wohlfarth

538.221 : 539.14

4134. THE GYROMAGNETIC RATIO OF VERY PURE NICKEL.
A.J.P.Meyer.
C.R. Acad. Sci. (Paris), Vol. 246, No. 10, 1517-19 (March 10, 1958).
In French.

The g' value of 99.998% pure Ni was found to be 1.845 ± 0.007 (cf. $g = 2.193 \pm 0.02$). E.P.Wohlfarth

538.221 : 539.382

4135. CALCULATED AND OBSERVED EFFECTS OF TEXTURE ON THE MAGNETIC PROPERTIES AND YOUNG'S MODULUS OF NICKEL SHEET. E.R.W.Jones, C.A.Clark and E.A.Fell.
Brit. J. appl. Phys., Vol. 9, No. 5, 178-84 (May, 1958).

Relative values of Young's modulus, magnetostrictive coupling coefficient and initial and maximum permeabilities are calculated for various textures in nickel, an approximate model being used for magnetic properties. Experimental values are given for high purity polycrystalline nickel sheet produced by powder metallurgy and annealed in purified hydrogen. Comparison between theory and experiment indicates good agreement for Young's modulus and fair agreement for magnetic properties. The textures were determined by X-ray photographic techniques and it was shown that strip possessing a cube recrystallized texture gave lower properties than recrystallized strip having a random grain orientation. It was also found, in agreement with previous work on copper, that the perfection of the cube texture was mainly governed by the temperature of anneal. A.

538.221 : 538.632

4136. HALL EFFECT AND FERROMAGNETISM OF VERY THIN NICKEL FILMS. R.Coren and H.J.Juretschke.
J. appl. Phys., Vol. 28, No. 7, 806-9 (July, 1957).

Hall effect measurements were used to determine the two Hall constants and the magnetic properties of nickel films less than 100 A thick at room temperature. The extraordinary Hall constant R_1 is found to be very much larger than in bulk nickel. In the thicker films, R_1 shows the resistivity dependence predicted by Karplus and Luttinger. For the thinner films, the deviation of the measured initial Hall slope from the value thus predicted is taken as a measure of the hardness of magnetization in the direction normal to the film plane. The saturation magnetization obtained in this manner, and its variation with film thickness, agree fairly well with values found by other methods. For the thinnest films the direction normal to the film plane is one of very hard magnetization. A.

538.221

4137. THE MAGNETIC PROPERTIES OF A SERIES OF NICKEL—COPPER ALLOYS. A.J.P.Meyer and C.Wolff.
C.R. Acad. Sci. (Paris), Vol. 246, No. 4, 576-9 (Jan. 27, 1958).
In French.

Reports results of determinations of the Curie temperatures θ and saturation moments σ_s, as well as of the reduced magnetization curves for alloys with up to 35% Cu; θ varies linearly to extrapolate to 0 at 57% Cu and σ_0 at 52% Cu. The temperature variation of σ is as $T^{3/2}$; the law of corresponding states is not obeyed. E.P.Wohlfarth

538.221

4138. ON THE TEMPERATURE DEPENDENCE OF THE PARAMAGNETIC SUSCEPTIBILITY OF FERROMAGNETIC ALLOYS.
D.I.Volkov and V.I.Chechernikov.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 1, 168-9 (1957).
In Russian.

The paramagnetic susceptibility (χ) was measured at various temperatures (T) from the ferromagnetic Curie point (Θ_f) to ~ 1200°C for a series of Ni alloys and a wide range of composition of each. For all these alloys $\chi = \chi_k + \chi_T$ where $\chi_T \cdot$ const. $(T - \Theta_p)$ and Θ_p = paramagnetic Curie temperature; χ_k is independent of T but depends on the concentration (ν) of the ferromagnetic element in the alloy. Thus a plot of T against $1/(\chi - \chi_k)$ gives a straight line for each alloy. At $T \cong \Theta_f$ there is a transition region where the magnetization (σ) is represented by $H = \alpha\sigma + \beta\sigma^3 + \gamma\sigma^5$ ($900\ Oe < H < 10\,000\ Oe$), α,β,γ all being functions of T and ν. Results agree with the s—d exchange model of a ferromagnetic. A.F.Brown

538.222 : 539.14

4139. REPRESENTATION OF EFFECTS OF THE OVERHAUSER TYPE. J.H.Manley.
Amer. J. Phys., Vol. 25, No. 8, 539-42 (Nov., 1957).

A discussion of observations in magnetic resonance experiments and their relations to the processes involved involves consideration of the populations of magnetic states. By adding a population coordinate to an energy diagram a representation is obtained by which the time change-of-state population can be illustrated. This is applied to effects of the Overhauser type (Abstr. 2550/1953) in solids, especially in semiconductors. A.

538.222

4140. MAGNETIC SUSCEPTIBILITY OF THE ALLOY Pt_3Fe BETWEEN 20 AND 900 DEGREES ABSOLUTE. J.Crangle.
Nature (London), Vol. 181, 644-5 (March 1, 1958).

The susceptibility v. temperature curve of an annealed, ordered specimen exhibits a maximum at 105°K and a minimum at 50°K; cold working destroyed the superlattice and rendered the alloy ferromagnetic. E.P.Wohlfarth

538.224 : 541.57

4141. DIAMAGNETISM AND HYDROGEN BOND.
K.Venkateswarlu and S.Sriraman.
Trans Faraday Soc., Vol. 53, Pt 4, 433-7 (April, 1957).

The diamagnetic susceptibility of benzoic acid, cinnamic acid and salicylic acid was determined in solution in a number of representative liquids at different concentrations. The results obtained are discussed on the basis of the formation of hydrogen bonds. A.

538.224

4142. THE DIAMAGNETIC SUSCEPTIBILITY OF OXALATE, TARTRATE AND CITRATE IONS. K.Venkateswarlu and S.Sriraman.
Trans Faraday Soc., Vol. 53, Pt 4, 438-41 (April, 1957).

The susceptibilities of oxalic acid, tartaric acid, citric acid and some of their metallic salts were determined in the solid state by using the Curie retorsion balance. The acids and some of the soluble salts are studied in aqueous solution using the Gouy method. From these observations the susceptibilities of the oxalate, tartrate and citrate ions are evaluated. The observed variations in the susceptibility values of the substances in the solid and dissolved states are explained on the basis of their structures. A.

538.24

4143. ON A NON-LINEAR THEORY OF TRANSITION PROCESSES IN A FERROMAGNETIC PLATE, MAGNETIZED BY A LONGITUDINAL ALTERNATING FIELD. N.N.Zatsepin.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 1, 30-6 (1957).
In Russian.

A series expansion is made for the field H(z,t) at times and positions z inside a one-dimensional ferromagnetic. Expressions are derived for the first (linear) and second (non-linear) terms of the series when the applied field has the form of a square wave.
A.F.Brown

538.24

4144. ON THE NON-LINEAR SURFACE EFFECT IN A FERROMAGNETIC CYLINDER MAGNETIZED CIRCULARLY. N.N.Zatsepin.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 2, 230-3 (1957).
In Russian.

The same methods as in an earlier paper (see the preceding abstract) are used to calculate the magnetic field in a cylinder magnetized by a continuously varying circular field. Account is taken of the cyclic variation of the magnetic susceptibility. A.F.Brown

538.24 : 538.652

4145. ON THE ADDITION OF A SECOND ANISOTROPY CONSTANT IN THE THEORY OF EVEN [CHETNÏ] EFFECTS. G.P.D'yakov.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 1, 161-2 (1957).
In Russian.

The author's theory of magnetostriction (Abstr. 3295/1949, 3674/1951) is modified by the addition of a further term to the series for crystalline anisotropy. This adds further (sometimes large) terms to the expression for the magnetostriction. A.F.Brown

538.244.2

4146. ON A POSSIBLE METHOD OF OBTAINING A HOMOGENEOUS MAGNETIC FIELD. L.A.Tseitlin.
Zh. tekh. Fiz., Vol. 27, No. 12, 2792-3 (1957). In Russian.

A uniform field exists within the inner of two confocal ellipsoids consisting of closely packed windings perpendicular to the major axis. The design equations are given. J.B.Arthur

538.245

4147. COMPARISON OF THE LAWS OF APPROACH TO SATURATION DEDUCED FROM MAGNETIZATION AND DIFFERENTIAL SUSCEPTIBILITY MEASUREMENTS. H.Dana .
C.R. Acad. Sci. (Paris), Vol. 246, No. 8, 1182-5 (Feb. 24, 1958).
In French.

Shows that Polley's results may be represented by $\chi H^3 = AI_0 + BH^{5/2}$, in agreement with an expression for the law of approach not containing an H^{-1} term. E.P.Wohlfarth

538.245

4148. THE APPROACH OF POLYCRYSTALLINE FERROMAGNETICS TO SATURATION AS H^{-2}. H.Danan.
C.R. Acad. Sci. (Paris), Vol. 246, No. 12, 1822-4 (March 24, 1958).
In French.

The effect of the K_2 term in the magnetocrystalline energy on the magnitude of the H^{-2} term in the law of approach has been investigated, and application is made to cobalt and iron.
E.P.Wohlfarth

538.245

4149. ON LINEAR TRANSITION PROCESSES TAKING PLACE IN A FERROMAGNETIC UNDER THE INFLUENCE OF APERIODIC, PULSED AND PERIODIC MAGNETIC FIELDS. N.N.Zatsepin.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 1, 41-7 (1957).
In Russian.

Formulae are derived for the magnetic field resulting from non-stationary processes in ferromagnetic plates placed in magnetic fields varying with time in the following ways: exponentially increasing, saw-toothed, square wave and sine wave.
A.F.Brown

538.245

4150. ON THE TEMPERATURE VARIATION OF THE SPONTANEOUS MAGNETIZATION IN ALLOYS IN THE NEIGHBOURHOOD OF THE CURIE POINT. K.Belov and Ya.Paches.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 1, 48-53 (1957).
In Russian.

The temperature variation of the spontaneous magnetization was determined in three independent ways for pure Ni and six Ni-based alloys. From analysis of the results the authors conclude that the Curie temperature (T_c) is most accurately calculated from thermodynamic data. Methods of calculating T_c which involve measurement of electrical resistivity, galvanomagnetic effect etc. are less accurate. A.F.Brown

538.245

4151. ON THE DOMAIN STRUCTURE OF A MANGANESE–BISMUTH ALLOY OF HIGH COERCIVITY.
Ya.S.Shur, E.V.Shtol'ts, G.S.Kandaurova and L.V.Bulatova.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 2, 234-40 (1957).
In Russian.

By means of powder figures it was shown that magnetization of Mg–Bi proceeded in two ways: (1) weak magnetizing fields allowed the formation of zones of reversed magnetization and gave coercivities (H_c) of up to 1000 Oe; (2) strong applied fields prevented the growth of reversed zones and gave H_c of several thousand Oe. It is believed that the same phenomena occur in other high-coercivity alloys but are not so easily observed as in Mg–Bi which is highly magnetically anisotropic. A.F.Brown

538.245

4152. DOMAIN PATTERNS ON A SINGLE CRYSTAL OF MANGANESE FERRITE. L.F.Bates, D.J.Craik and P.M.Griffiths.
Proc. Phys. Soc., Vol. 71, Pt 5, 789-96 (May, 1958).

Powder patterns were obtained on the cleaved surface of a single crystal of manganese ferrite by using a modification of the normal powder-pattern technique. Two types of patterns were observed, a large scale pattern having a "fern"-like structure, and an underlying structure of exceptional fineness and unusual configuration. A.

538.245

4153. MAGNETIC ANISOTROPY IN CONNECTION WITH ROLLING IN THE COURSE OF PRODUCING SINGLE CRYSTALS OF SILICON STEEL. T.Yamashita and E.Tatsumoto.
J. Phys. Soc. Japan, Vol. 12, No. 8, 975 (Aug., 1957).

A magnetic anisotropy associated with the rolling of single crystal strips is attributed to arrays of nearly spherical pits aligned parallel to the rolling direction. The value of the anisotropy is observed to be 400 erg/cm^3. A.E.De Barr

538.245 : 537.533.2

MAGNETIZATION AND FIELD EMISSION OF FERROMAGNETICS. See Abstr. 4064

538.248

4154. SOME COMMENTS ON THE THEORY OF COERCIVE FORCE OF FINE PARTICLES. T.Ohoyama.
J. Phys. Soc. Japan, Vol. 12, No. 7, 827 (July, 1957).

The calculation of the coercive force of fine particles is discussed in terms of Kittel's and Neel's models. It is concluded that further calculation is necessary to determine whether or not the coercive force depends upon the diameter of the particles.
A.E.De Barr

538.27

4155. THE MAGNETO-CALORIC EFFECT AT PHASE CHANGES IN FERROMAGNETIC ALLOYS. V.I.Ivanovskiĭ and P.P.Denisov.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 3, 550-2 (1957).
In Russian.

A letter describing briefly the method of accurate determination of the Curie point by measuring the magneto-caloric ΔT as a function of temperature (T). Experiments on Fe_3Al showed a very sharp maximum of the $\Delta T/T$ curve at 590° C corresponding to the usual Curie point, and also a broad maximum at about 475° C. This is taken to be the Curie point of another ferromagnetic phase. Similar experiments on Alnico also showed two Curie points, one at about 800° C, the other at about 900° C. A.F.Brown

ELECTROMAGNETISM. ELECTRODYNAMICS

538.3 : 621.3.011

4156. RATIONAL MAGNITUDES CHARACTERIZING THE ELECTRIC AND MAGNETIC FIELDS. THEIR NATURE. UNITS. A.Iliovici.

Bull. Soc. Franç. Elect., Vol. 8, 123-34 (Feb., 1958). In French.

It is shown that the non-rational form of certain equations of electromagnetism arise from the fact that the formulae defining electrostatic induction and magnetic field are based on action at a distance. If the effect which an electron at rest or in motion has on free space is considered, rational forms are obtained. This leads to the creation of new units. Definitions of the principal units are proposed and modifications of present terminology suggested.

R.C.Glass

538.3 : 532.5

4157. NOTE ON INDUCTION DRAG. K.P.Chopra.
J. geophys. Res., Vol. 62, No. 1, 143-6 (March, 1957).

Some aspects of induction drag are briefly described. The quoted expressions for translational and rotational induction drags of a sphere of infinite electrical conductivity moving in an incompressible fluid of finite electrical conductivity in the presence of a magnetic field may be derived following an earlier paper (Abstr. 8025/1957). An analogy with the viscous drag is drawn, and it is shown that, unlike ordinary viscosity, the hydromagnetic or inductive viscosity is anisotropic in nature. A condition for this second viscosity to play an important role is also obtained. The limitations of the results obtained are discussed and it is shown that the results hold good for small bodies or weak induction currents. When applied to large bodies or strong currents, the appropriate corrections for the electromagnetic and for electrostatic shielding effects must be applied. An order of magnitude calculation shows that, for bodies of cosmical dimensions, the correction is precisely of the same order as the induction effect itself. A.

538.3 : 530.145

4158. A SPINOR REPRESENTATION OF MAXWELL'S EQUATIONS. H.E.Moses.
Nuovo Cimento Suppl., Vol. 7, No. 1, 1-18 (1958).

Maxwell's equations are written in a form which is formally identical with Dirac's equation. One of the four components of the wave-function is zero and the other three are H_k-iE_k. The transformation law for the "Dirac" matrices is uniquely determined, and is different from the usual one. J.C.Taylor

538.3 : 530.12

THE EQUATIONS OF ELECTROMAGNETIC INDUCTION. See Abstr. 3673

538.3 : 532.5

4159. AN ENERGY PRINCIPLE FOR HYDROMAGNETIC STABILITY PROBLEMS.
I.B.Bernstein, E.A.Frieman, M.D.Kruskal and R.M.Kulsrud.
Proc. Roy. Soc. A, Vol. 244, 17-40 (Feb. 25, 1958).

The problem of the stability of static, highly conducting, fully ionized plasma is investigated by means of an energy principle developed from one introduced by Lundquist (see Abstr. 7109/1951, 5916/1952). The derivation of the principle and the conditions under which it applies are given. The method is applied to find complete stability criteria for two types of equilibrium situations. The first concerns plasmas which are completely separated from the magnetic field by an interface. The second is the general axisymmetric system. A.

538.3 : 532.5

4160. THE INSTABILITY OF A PINCHED FLUID WITH A LONGITUDINAL MAGNETIC FIELD. M.Kruskal and J.L.Tuck.
Proc. Roy. Soc. A, Vol. 245, No. 1241, 222-37 (1958).

The stability of a pinched plasma equilibrium with a longitudinal magnetic field superimposed on the characteristic azimuthal magnetic field of the pinch current is studied theoretically. The linearized solutions are developed as helical perturbations of the plasma surface, and the behaviour of these is given for the different cases of uniform longitudinal, longitudinal field zero inside the plasma, and for helices of the same and opposite sense to the helix which describes the total magnetic field. Approximately, the conclusions are: that the longitudinal field has the effect of stabilizing short-wave perturbations, but that some long-wave perturbations remain unstable no matter how large the externally imposed longitudinal magnetic field. A.

538.3 : 532.5

4161. ON THE EQUATIONS OF MAGNETOHYDRODYNAMICS.
G.Carini.
R.C. Accad. Naz. Lincei, Vol. 21, No. 6, 436-41 (Dec., 1956).
In Italian.

The Eulerian hydromagnetic equations for a moving medium are compared with those originally introduced by Alfvén. The two systems are found to be equivalent only for certain special cases. See also Abstr. 8026 (1957). R.A.Newing

538.3.081 : 537.081

THE RATIONALIZATION IN ELECTROMAGNETISM AND ELECTROSTATICS. See Abstr. 3963

ELECTROMAGNETIC WAVES AND OSCILLATORS

538.56 : 535.1 : 517.3

4162. CYLINDER RADIATION AND ACTIVATION.
A.V.H.Masket, R.L.Macklin and H.W.Schmitt.
Rev. sci. Instrum., Vol. 28, No. 3, 189-90 (March, 1957).

In the calculation of the interaction of radiation from a point source with a body (or conversely, the intensity of radiation from an emitting body at a point in space), a somewhat complex exponential integral must be evaluated. If the interaction in the body is small, however, the integral may be approximated by $I = \int V dv/R^2$, where V is the volume of the body and R is the distance from the point to the volume element dv in the body. This integral is discussed and applied to the case of a cylindrical body. Extensive tables (over 12 000 entries) and formulae were prepared that will facilitate the determination of the value of this integral for a cylinder of any size and any point in space. A discussion of non-negligible absorption and multiple interactions is also included. A.

538.561

4163. RADIATION FIELD OF AN OSCILLATING DIPOLE. L E.M.Ferreira.
An. Acad. Brasil. Ciênc., Vol. 28, No. 1, 83-94 (1956).

The problem of the emission of radiation can be formulated in a closed form in the special case in which the radiation source can be considered to be an harmonic oscillator. An approximate solution of the problem, neglecting the reaction of the radiation field, and corresponding closely to the classical theory, is obtained. Radiation reaction is found to be closely connected to the behaviour of the system near resonance. A.

538.561 : 621.371

4164. INDUCTION AND EMISSION OF AN ELECTROMAGNETIC WAVE. J.Janžeković.
Elektroteh. Vestnik, Vol. 24, No. 6-8, 153-61 (June-July-Aug., 1956).
In Slovene with French translation ibid., a9-a16.

Induction and radiation of an electromagnetic wave is considered for a thin flat plate bearing oscillating electric or magnetic changes. In particular impedance and radiation pressure are determined. Consideration of a rectangular loop leads to the velocity of propagation of the waves. Analogous equations would apply to the gravitational field radiated from a shell whose mass varied sinusoidally with time. W.T.Blackband

538.561 : 537.56

4165. OSCILLATIONS IN A PLASMA WITH ORIENTED (D.C.) MAGNETIC FIELD. L.Gold.
J. Electronics and Control, Vol. 4, No. 5, 409-16 (May, 1958).

The behaviour of a low energy plasma in a d.c. electric (E) and magnetic (B) field is investigated for any orientation. In bypassing the Boltzmann transport procedure, it is established in a straightforward manner that oblique alignment can give rise to double resonances; these represent coupling of ω_p the plasma and ω_c the cyclotron oscillations. While the transverse E, B case is characterized by a single dispersion frequency $\omega^2 = \omega_c^2 + \omega_p^2$, the longitudinal case E, B admits individually the decoupled plasma and cyclotron resonances. The actual manifestation of such oscillations in gas discharges demands fulfillment of certain conditions. The role of collisional damping, plasma thermal energy and current density is indicated. A.

538.561 : 537.56 : 621.376.22 : 621.372.822 : 621.387

4166. THE PLASMA RESONATOR. A.Dattner.
Ericsson Tech., Vol. 13, No. 2, 309-50 (1957).

The interaction between an ionized gas column and an electromagnetic wave in a waveguide is studied, and plasma resonance effects are found. The influence of discharge current and collisions in the gas upon the resonance effect is investigated. Decay times of the electron density are determined. Noise modulation of the r.f. power by the plasma resonator is measured and an application of the device as an amplitude modulator for microwaves is demonstrated. The influence of the plasma column cross-section and the magnetic field on transmission characteristics is studied. The results are discussed qualitatively and resonance discharge current is computed. A.

538.561 : 621.375.9

4167. PROPOSED NEGATIVE-MASS MICROWAVE AMPLIFIER. H.Krömer.
Phys. Rev., Vol. 109, No. 5, 1856 (March 1, 1958).

At high kinetic energies electrons and holes can have negative effective masses. Thus the semiconductor can be considered a negative resistance. Negative masses occur close to the band edge if the energy contours are re-entrant. An amplifier is proposed with p-type germanium, biased by a few kV/cm. Under these conditions the effective mass is expected to be approximately $-0.3\ m_0$. Other types of semiconductor could also be used. The frequency response should be limited by the collision time of the electrons, i.e. about 1000 kMc/s. D.Walsh

538.561 : 621.375.9

4168. THEORY OF THE FERROMAGNETIC MICROWAVE AMPLIFIER. H.Suhl.
J. appl. Phys., Vol. 28, No. 11, 1225-36 (Nov., 1957).

All three possible types of operation using, respectively, two electromagnetic cavity modes, two sample modes, and one sample and one cavity mode, are discussed. One especially simple case, that of a sphere in the first type of operation, is treated separately. Thereafter all three cases are discussed in terms of scalar and vector potentials. The gain-bandwidth problem is dealt with, and an expression given for the equivalent "negative Q" of the sample. A.

538.561 : 621.375.3

4169. NEW TYPE OF FERROMAGNETIC AMPLIFIER.
C.L.Hogan, R.L.Jepsen and P.H.Vartanian.
J. appl. Phys., Vol. 29, No. 3, 422-3 (March, 1958).

A simple physical explanation is given of the mechanism of microwave amplification by coupling local oscillator energy to signal energy as proposed by Suhl (Abstr. 6363/1957). A.

538.561 : 621.375.9

4170. THE SOLID-STATE MASER — A SUPERCOOLED AMPLIFIER. J.W.Meyer.
Electronics, Vol. 31, No. 17, 66-71 (April 25, 1958).

Describes the principle of operation and characteristics of the ammonia maser and the three-level solid-state maser. The measurement of maser noise figure is discussed and possible future developments of the device are indicated. R.C.Glass

538.561 : 621.375.9

4171. MASER AMPLIFIER CHARACTERISTICS FOR TRANSMISSION AND REFLECTION CAVITIES. M.L.Stich.
J. appl. Phys., Vol. 29, No. 5, 782-9 (May, 1958).

The noise temperature, band-width, and gain modulation characteristics of a transmission maser are obtained as a function of iris coupling for fixed desired gain and other parameters. It is found that certain of these characteristics can be optimized at the expense of others. The same functions are compared in the case of a reflection maser. The reflection maser is shown to be superior in most respects, although the same noise temperature may be attained with the transmission maser at a substantial sacrifice in band-width and gain modulation. The reflection maser is also limited by the availability of good circulators, while a transmission maser can be made independent of load. A figure of merit Q_0Z for both types of maser amplifier is obtained, where Q_0 is the unloaded cavity Q and $Z = 4\pi\xi\chi_0 - Q_0^{-1}$ (ξ is the filling factor and χ_0 the negative r.f. susceptibility). When the cavity band-width is much less than the susceptibility band-width, an auxiliary figure of merit is Z. A.

538.561 : 621.375.9

4172. CHARACTERISTICS OF THE BEAM TYPE MASER. I. K.Shimoda.
J. Phys. Soc. Japan, Vol. 12, No. 9, 1006-16 (Sept., 1957).

The velocity distribution of molecules in the beam-type maser is considered fairly completely, though the mathematical approach is rather approximate. Because slower molecules spend a longer time in the cavity, the effective average velocity of molecules is considerably smaller than the most probable velocity, when the r.f. power-level and the focusing voltage are low. Amplitude v. focusing voltage and v. frequency characteristics are obtained, which seem to be in good agreement with experimental results. Frequency shift due to the unresolved hyperfine structure is discussed and shown to be appreciable (a few parts in 10^8). A.

538.561 : 621.375.9

4173. OPERATION OF A THREE-LEVEL SOLID-STATE MASER AT 21 cm. J.O.Artman, N.Bloembergen and S.Shapiro.
Phys. Rev., Vol. 109, No. 4, 1392-3 (Feb. 15, 1958).

A three-level solid state maser has amplified and oscillated at 1373 Mc/s, with a pumping frequency of 8000 Mc/s, at below 2°K. A single crystal of $K_3Co(CN)_6$, with 0.5% Co replaced by Cr, was used in a doubly-resonant, fixed-tuned cavity. The pumping power necessary to start oscillation was 9 mW. A power gain of 10 at low signal levels and a gain saturation in the microwatt region were measured. D.Walsh

538.561 : 621.375.9

4174. MASER ACTION IN RUBY.
G.Makhov, C.Kikuchi, J.Lambe and R.W.Terhune.
Phys. Rev., Vol. 109, No. 4, 1399-400 (Feb. 15, 1958).

A three-level maser using ruby (Al_2O_3 : Cr) was operated at 9.3 Gc/s with a pumping frequency of 24 Gc/s in a doubly resonant cylindrical cavity. Evidence of amplification and oscillation at 2°K was found with a 0.2 cm^3 sample having 0.1% Cr concentration. A net gain of 20 dB was observed. D.Walsh

538.561 : 621.375.9

4175. 21-CENTIMETER SOLID-STATE MASER.
S.H.Autler and N.McAvoy.
Phys. Rev., Vol. 110, No. 1, 280-1 (April 1, 1958).

A three-level solid-state maser was operated as an amplifier at 1382 Mc/s. Saturating power was supplied at 9070 Mc/s at a power level of 28 mW. The gain–bandwidth product was 1.85×10^6 sec^{-1} over a considerable range. The material, $\frac{1}{2}\%$ $K_3Cr(CN)_6$, was placed in a cavity with high filling factor. H.Motz

538.561 : 621.373.1

4176. MASER OSCILLATOR WITH ONE BEAM THROUGH TWO CAVITIES. W.H.Wells.
J. appl. Phys., Vol. 29, No. 4, 714-17 (April, 1958).

A two-cavity beam type of maser is studied by a geometrical representation of the Schrödinger equation developed by Feynman, Vernon and Hellwarth (Abstr. 3981/1957). By this method complicated effects may be readily visualized. As an example, the qualitative explanation is developed for the experimental observation that a cavity in a maser will oscillate simultaneously at two frequencies (differing by 1000 to 5000 c/s) under certain conditions when the beam is first passed through another cavity. A possible amplifier application is noted. A.

538.563 : 621.317.323

4177. UNIVERSAL MICROWAVE PROBE.
R.E.Comley and R.J.Talham.
Amer. J. Phys., Vol. 25, No. 8, 568-9 (Nov., 1957).

A probe for electromagnetic waves was developed and employed for demonstrations of both standing electric waves and standing magnetic waves. The field patterns were not appreciably altered by the probe since its dimensions were less than one-tenth of a wavelength. A.

538.566 : 621.371

4178. PRECISION DETERMINATION OF THE VELOCITY OF ELECTROMAGNETIC WAVES. K.D.Froome.
Nature (London), Vol. 181, 258 (Jan. 25, 1958).

The free-space phase velocity of electromagnetic waves in vacuo was measured by means of an interferometer operating at a frequency of 72 Gc/s. The result is $c_0 = 299\,792.50 \pm 0.10$ km/s. A.H.Cook

538.566

4179. DIFFRACTION OF 3.2 cm ELECTROMAGNETIC WAVES BY DIELECTRIC RODS. III. LUCITE $1\frac{1}{2}$ IN. DIAMETER SEMI-CYLINDER, FIELDS VERY CLOSE TO SURFACE.
C.E.Jordan and A.B.McLay.
Canad. J. Phys., Vol. 35, No. 11, 1253-64 (Nov., 1957).

For Pt II, see Abstr. 6036 (1956). The problem was investigated more thoroughly than previously. The incident field was polarized parallel to the long axis of the semicylinder. In addition, the field near the rod when it was oriented with plane surface aligned with the axis of propagation, and the field when the same rod was coated with thin aluminium foil and placed in turn in each of the three above-mentioned orientations, were observed. A number of features in the diffraction patterns of the uncoated lucite rod were qualitatively accounted for as resulting from effects of weak radiation after one or more internal reflections, or from evanescent waves close to a part of the surface where internal incidence is at angles greater than critical, superposed on one or more of the incident, directly-transmitted and externally-reflected radiations. The patterns a little away from the surface of the uncoated rod and the whole patterns of the aluminium-coated one are relatively quite simple and provide evidence of marked near-field diffraction. A.

538.566

4180. DIFFRACTION OF ELECTROMAGNETIC WAVES BY RIBBON AND SLIT. I. Y.Nomura and S.Katsura.
J. Phys. Soc. Japan, Vol. 12, No. 2, 190-200 (Feb., 1957).

Rigorous solutions are presented of the problem of diffraction of plane electromagnetic waves by an infinitely thin, perfectly conducting, infinitely long ribbon, and by an infinitely long slit in a plane conducting-screen, where the plane of incidence is perpendicular to the edge of the ribbon or slit but where the angles of incidence and polarization are arbitrary. The unique solution satisfying the edge condition is obtained from the electric and magnetic type Hertz vectors, each of which has one scalar component, by the method of expansion in the hypergeometric polynomial. The expressions for the scattering coefficient, transmission coefficient, electric current on the ribbon, electric field in the slit, and electric field at a distance, are obtained as a function of $ka = 2\pi a/\lambda$. A.

538.566 : 621.372

4181. ON THE THEORY OF PROPAGATION OF ELECTROMAGNETIC WAVES ALONG A CURVED SURFACE. J.R.Wait.
Canad. J. Phys., Vol. 36, No. 1, 9-17 (Jan., 1958).

The problem of propagation of vertically polarized waves along a surface whose curvature and electrical properties have a discontinuity is considered. The mutual impedance Z between two short vertical aerials on either side of the boundary of separation is considered to be the fundamental quantity which is sought. By utilizing the principle of stationary phase and the concept of surface impedance, an approximate expression is derived for Z. It is shown that to a first order of magnitude, the effects of the conductivity contrast and curvature change are additive corrections to the mutual impedance between dipoles over a single homogeneous spherical surface. A.

538.566 : 621.396.677

4182. ON FOCUSING ELECTROMAGNETIC RADIATORS. R.W.Bickmore.
Canad. J. Phys., Vol. 35, No. 11, 1292-8 (Nov., 1957).

The transmission of electromagnetic energy between two apertures is examined as a function of their sizes, separation, excitation functions and surface shapes, with Fresnel approximations made throughout. Relations are derived which show when it is advantageous to focus the apertures by curving about a spherical surface. A.

538.566 : 621.396.677.71

4183. RADIATION AND SURFACE CURRENTS FROM A SLOT ON AN INFINITE CONDUCTING CYLINDER. F.H.Northover.
Canad. J. Phys., Vol. 36, No. 2, 206-17 (Feb., 1958).

The far field produced by an aperture in the surface of an infinite cylindrical aerial, whose interior is being electromagnetically excited in some way, was calculated by Papas and others using a "saddle-point" method of approximation to the infinite integrals which express the external field. This method will not, however, serve to approximate to the far field near the aerial surface. Also, there seems to have been no attempt so far to estimate the order of magnitude of the error involved in using formulae derived by such methods. The object of the present paper is to remedy these deficiencies and to provide a basis for the calculation of the far field in wider regions than has so far been possible. In particular, the surface current distribution at large distances from the aperture has been worked out. Finally, a justification is given for the Papas procedure of integrating his approximation to the Poynting energy flux vector over the whole of the portion of the large sphere surrounding the aperture which is outside the cylinder itself. A.

538.566 : 621.396.677.832

4184. FIELD OF A DIELECTRIC-LOADED, INFINITE CORNER REFLECTOR. A.W.Adey.
Canad. J. Phys., Vol. 36, No. 4, 438-45 (April, 1958).

A study was made of the effect on the radiating properties of an infinite corner reflector of loading its apex with a section of a dielectric cylinder of polystyrene and of a material with a relative permittivity of 4. Calculations of the radiation resistance and of the far-field amplitude have shown them to be sensitive to the presence of the loading, particularly for small spacings of the feeding element from the apex. A.

538.566

4185. THE ABSORPTION OF MICROWAVES BY GAS MIXTURES. G.Boudouris and D.Ilias.
C.R. Acad. Sci. (Paris), Vol. 246, No. 5, 730-3 (Feb. 3, 1958).
In French.

Microwave absorption at 9400 Mc/s (32 mm) of mixtures of NH_3 with argon and chloroform was measured at 0°C and for pressures from 20 to 200 mm Hg. Using the known absorption coefficient of NH_3 an expression is derived which fits the experimental results. R.C.Seymour

538.566.2

4186. REFLECTION OF AN ELECTROMAGNETIC WAVE BY AN ATMOSPHERIC LAYER PRESENTING A VARIATION OF REFRACTIVE INDEX. F.du Castel, P.Misme and J.Voge.
C.R. Acad. Sci. (Paris), Vol. 246, No. 12, 1838-40 (March 24, 1958).
In French.

A method is indicated whereby the reflection coefficient may be calculated for a variety of different types of gradient of refractive index. G.M.Brown

538.566.2 : 621.396.8

4187. ON THE VARIATION OF THE POLARIZATION OF ULTRA-SHORT WAVES DUE TO AN INHOMOGENEITY IN THE TROPOSPHERE. G.Eckart.
C.R. Acad. Sci. (Paris), Vol. 244, No. 25, 3044-5 (June 17, 1957).
In French.

The observation that the field radiated by a vertical aerial is often no longer vertically polarized at a receiving point is explained by the introduction of a term representing an inhomogeneity in the dielectric constant. G.M.Brown

538.566.3 : 621.396.8

4188. POLARIZATION OF ELECTROMAGNETIC WAVES FOR VERTICAL PROPAGATION IN THE IONOSPHERE.
R.Roy and J.K.D.Verma.
J. geophys. Res., Vol. 60, No. 4, 457-82 (Dec., 1955).

A theoretical study of the variation of the state of polarization of a vertically incident electromagnetic wave while in propagation in the ionosphere was made on the basis of an approximate solution of the wave equations obtained by Saha, Banerjee and Guha (Abstr. 8860/1951). It was shown that the major axes of the polarization ellipses of both the ordinary and the extraordinary waves would lie in the N—E quadrant in the northern hemisphere and in the N—W quadrant in the southern hemisphere. A new method is outlined for the determination of the electron density and the collision frequency in the ionized layers from the value of the tilt-angle and the ratio of axes of the elliptic patterns. An analysis of the characteristics of the experimentally observed polarization patterns indicates that in the E layer the value of ν is 1.7×10^6 per second. They further show that the polarization of the downcoming waves corresponds to their respective reflection levels, rather than a limiting region below the E layer. A.

538.566.3 : 551.510.535

4189. CALCULATIONS OF IONOSPHERIC REFLECTION COEFFICIENTS AT VERY LOW RADIO FREQUENCIES.
J.R.Wait and L.B.Perry.
J. geophys. Res., Vol. 62, No. 1, 43-56 (March, 1957).

A set of calculated curves is presented for the reflection coefficients at a sharply bounded homogeneous ionized medium with a superimposed magnetic field. The results are plotted parametrically to permit general comparisons with experimental data. Both steady-state and transient cases are considered. A.

538.566.3 : 551.510.535

4190. RADIO FREQUENCY AND SCATTERING ANGLE DEPENDENCE OF IONOSPHERIC SCATTER PROPAGATION AT V.H.F. A.D.Wheelon.
J. geophys. Res., Vol. 62, No. 1, 93-112 (March, 1957).

The weak and fluctuating radio signals observed at distances of 1500 km on v.h.f. are attributed to scattering from E region turbulence. It is noted that propagation constants $k = 4\pi/\lambda \sin(\theta/2)$, corresponding to the experimental frequencies (28 to 108 Mc/s), just straddle the viscosity cut-off wave-number $k_s = 0.5\,m^{-1}$ of the region thereby giving a qualitative explanation for the curious dichotomy found in the experimental data. The two competitive turbulence theories are then developed in detail near the viscosity transition range. It is found that pressure fluctuations of the ionosphere's neutral gases induce a spectrum of dielectric variations which reproduce the frequency and scattering angle dependence of the experimental results quite well. A theory of turbulent mixing of ionization gradients is then developed along the lines of Heisenberg's original treatment of the velocity field. This process predicts a frequency variation of power levels, which is also satisfactory. It is concluded that more precise, simultaneous measurements will be required to choose between the two theories on this basis. A.

538.566.3 : 551.510.535

4191. DIURNAL VARIATIONS OF SIGNAL LEVEL AND SCATTERING HEIGHTS FOR V.H.F. PROPAGATION. A.D.Wheelon. J. geophys. Res., Vol. 62, No. 2, 255-66 (June, 1957).

The scattering of v.h.f. radio waves in the lower ionosphere is identified with turbulent fluctuations of the electron plasma. The theory of gradient mixing is applied to the afternoon and early evening periods, for which solar control is thought to dominate meteoric contributions. The scattering cross-section for this process,

$$\sigma = 2\pi^2 r_0^2 \left(\frac{dN}{dh}\right)^2 \left[\frac{4\pi}{\lambda} \sin\left(\frac{\theta}{2}\right)\right]^{-5}$$

depends on ionospheric conditions only through the ambient electron density–height profile's gradient dN/dh. It is found that the afternoon decay of signal strength and simultaneous increase of scattering height can be correlated with independent estimates of electron density and recombination coefficients in the lower ionosphere. The observation of two scattering levels on short paths and the lack of a midday maximum on long paths is predictable. Diurnal variations of the frequency dependence of these transmissions suggest a strong influence of the earth's magnetic field. A.

538.566.3 : 621.396.8

4192. ABNORMAL POLARIZATION OF THE ATMOSPHERIC PULSES REFLECTED SUCCESSIVELY FROM THE IONOSPHERE. S.R.Khastgir.
Nature (London), Vol. 181, 404-5 (Feb. 8, 1958).

During the recording of atmospherics in India, many cases of elliptic patterns have been observed on the c.r.t. direction-finder. These showed continuously changing eccentricity and tilt-angle, and almost certainly represent abnormal polarization of the atmospheric pulses reflected successively from the ionosphere.

G.M.Brown

NUCLEAR AND ATOMIC PHYSICS

539.1

4193. POSSIBLE EXISTENCE OF ANTI-MATTER IN BULK. P.J.Wyatt.
Nature (London), Vol. 181, 1194 (April 26, 1958).

APPARATUS. PARTICLE DETECTORS

539.1.07

4194. ROLE OF PHOTONS IN ARGON–ALCOHOL COUNTERS. P.Mortier, O.Demuynck and O.Segaert.
Nature (London), Vol. 181, 1327-8 (May 10, 1958).

Describes experiments on the velocity of discharge spread in divided-cathode Geiger counters, which suggest that the dominant part of the discharge spread mechanism is due to hard photons.

J.D.Craggs

539.1.07

4195. ENCAPSULATION MAKES MONITOR INDEPENDENT OF ENVIRONMENT. M.H.Jachter and A.E.Cohen.
Nucleonics, Vol. 15, No. 9, 148, 150, 152 (Sept., 1957).

A γ-ray measuring ion-chamber, with its associated electrometer valve, is hermetically sealed with epoxy resin.

R.D.Smith

539.1.07

4196. IONIZATION CHAMBERS FOR ALPHA PARTICLE COUNTING. S.S.Bugorkov, L.Z.Malkin, K.A.Petrzhak, V.A.Yakovlev and M.I.Yakunin.
Pribory i tekh. Éksper., 1957, No. 4, 16-19. In Russian.

The construction and properties of five ionization chambers are described. The chambers were designed for work with α-active materials of different form, dimensions and activity, in solid or liquid state. The chambers are simple in construction and convenient in practice. S.Chomet

539.1.07

4197. LOW-RATE NEUTRON DOSIMETER. I.L.Karp.
Rev. sci. Instrum., Vol. 28, No. 11, 902-4 (Nov., 1957).

An instrument for the monitoring of personnel in combined neutron and a gamma radiation fields is shown to record the rem dose due to fast and slow neutrons and gamma rays. The instrument consists of a thermal neutron ionization chamber worn under the arm. The relative neutron to gamma response is trimmed by means of a gadolinium coating on the ionization chamber. The use of the human body as the moderator is discussed. A.

539.1.07

4198. IMPROVED LOW-LEVEL ALPHA-SCINTILLATION COUNTER FOR RADON. H.F.Lucas.
Rev. sci. Instrum., Vol. 28, No. 9, 680-3 (Sept., 1957).

A low counter background was obtained by use of steel for the shell and quartz for the counter window, while marked improvement in the stability was obtained by coating the window with an electrically conducting layer of tin oxide. The distribution of radon and its daughter nuclei within the counter under various conditions was determined by comparison of observed and calculated counting efficiencies. A stable counting efficiency of 5.58 ± 0.05 (counts min^{-1})/$\mu\mu c$ radon and a background counting rate of 0.08 counts/min were obtained. The usefulness of this counter was augmented by adsorbing the radon on charcoal. The radon was then easily transferred to the counter with a small volume of helium and a Sigmamotor pump. This system is suitable for the analysis of samples of radon as small as 10^{-14} c or concentrations in air smaller than 10^{-16} c radon/litre. A.

539.1.07

4199. THREE-CHANNEL ALPHA-FISSION COUNTER. F.A.White and J.C.Sheffield.
Nucleonics, Vol. 16, No. 4, 86, 88, 90 (April, 1958).

The instrument was developed for measurements of the capture–fission cross-section ratio for fuel at low neutron energies. A neutron beam first traverses a thin B^{10} film, and then two films of the fissionable material being investigated. Between the two thin films is an absorbing layer of the same fissionable material. The films are isolated by Al foil and the counts from all three films recorded separately. The B^{10} α-counter monitors the intensity of the incident beam, and the counting rates of the two fission foils yield the relative fission and absorption cross-sections.

R.D.Smith

539.1.07

4200. AN ADVANCED LABORATORY PROJECT: CONSTRUCTION OF A WILSON CLOUD CHAMBER. R.L.Tanner.
Amer. J. Phys., Vol. 26, No. 1, 12-13 (Jan., 1958).

A 6 in. diameter Wilson cloud chamber was constructed by senior students as a project in an atomic and nuclear physics course. The planning and actual machine work were student performed and several good pictures of alpha tracks were made using the apparatus. A.

539.1.07

4201. A FAST-OPERATED WILSON CLOUD CHAMBER SYNCHRONIZED WITH A SYNCHROTRON. I.P.Yavor and A.P.Komar.
Zh. tekh. Fiz., Vol. 27, No. 4, 868-74 (1957). In Russian.

The conversion of a conventional Wilson cloud chamber of 30 cm diameter into an over-compression chamber, working with a period of from 10 to 15 sec, is described and some technical and constructional details are reported. The block diagram of the electronics for the synchronization of the chamber with pulses from a synchrotron operated at 50 c/s is also given and discussed in some detail. G.Martelli

539.1.07

4202. BUBBLE CHAMBERS. E.V.Kuznetsov.
Uspekhi fiz. Nauk, Vol. 64, No. 2, 361-89 (1957). In Russian.

The paper forms a short and relatively advanced monograph on the topic, covering physical principles, design, working liquids, working characteristics, and the measurement of particle velocity. 49 references (about a third of which are Russian).

C.R.S.Manders

539.1.07

4203. THE RANGE–ENERGY RELATION IN EMULSION. I. RANGE MEASUREMENTS. W.H.Barkas, P.H.Barrett, P.Cüer, H.Heckman, F.M.Smith and H.K.Ticho.
Nuovo Cimento, Vol. 8, No. 2, 185-200 (April 16, 1958).

Simultaneous exposures were made of Ilford G.5 emulsion to magnetically analysed mesons as well as to hydrogen and helium nuclei of various velocities. Measurements of the particle ranges were made for equivalent proton energies of 1.295 MeV to 700 MeV. Individual particle momenta were known to better than one part in a thousand. Especial care was taken to maintain the emulsion density at an accurately measured value. Curves and formulae used for converting particle ranges to their proton equivalents at other emulsion densities are given. Detailed procedures for correcting ranges of particles that traverse gaps between pellicles are described.

Various effects that influence range measurements are discussed. Comparisons with existing data are made. Good agreement is found to exist only when the emulsion densities are known, and a correct procedure is employed to adjust the measured ranges to standard conditions. An empirical correction of the Vigneron range table is made. A.

539.1.07

4204. THE RANGE–ENERGY RELATION IN EMULSION. II. THE THEORETICAL RANGE. W.H.Barkas.
Nuovo Cimento, Vol. 8, No. 2, 201-14 (April 16, 1958).

The Bethe–Bloch theory of stopping, including shell corrections and the density-effect correction, is used to calculate theoretical ranges for standand Ilford G.5 emulsion. Only the mean ionization potential is an adjustable parameter. Making corrections for the K shells of all emulsion atoms except hydrogen, and also correcting for the L shells of iodine, silver, and bromine, one can obtain a fit to the measured ranges for protons of 1 to 700 MeV. The mean ionization potential found is (331 ± 6) eV, and I/Z has a value of (12.1 ± 0.2) eV as an average for all emulsion elements except hydrogen. At low velocities the hydrogen-like atomic model used in the shell-correction calculations appears to over-accentuate the shell effects. A better agreement with the experimental data for proton energies below 40 MeV is obtained semiempirically. A range table for emulsion of standard density is given. A calculated range table for water, useful for adjusting ranges measured under non-standard density conditions, is also included. A.

539.1.07

4205. ABSOLUTE FLUX MEASUREMENT OF ANISOTROPIC NEUTRON SPECTRA WITH PROTON RECOIL TRACKS IN NUCLEAR EMULSIONS. J.H.Roberts.
Rev. sci. Instrum., Vol. 28, No. 9, 677-80 (Sept., 1957).

A technique for the measurement of neutron spectra which is independent of neutron direction was studied. The technique consisted of measuring all proton tracks in a known volume of type C2 Ilford emulsion, in which shrinkage was reduced by treating the plates with rosin. By a suitable differentiation of the proton spectrum the absolute flux of neutrons as a function of energy was determined. Rotated plates were exposed to 0.8 and 1.3 MeV neutrons. Four thousand tracks were measured, and two peaks with a width ~150 keV at half-maximum were obtained. The statistical accuracy of the neutron flux in the two peaks is about 10%. The flux determination was checked by a fixed C2 plate, in which the conventional proton recoil method was used. Good agreement was obtained. A.

539.1.07

4206. APPLICATION OF THE FILM–SCINTILLATOR SYSTEM TO THE DETECTION OF γ-RAYS. R.M.Kogan and N.K.Pereyaslova.
Pribory i tekh. Eksper., 1957, No. 4, 25-7. In Russian.

A method is described for measuring weak γ-ray intensities as functions of time. A film is passed continuously over a well-type NaI crystal. Thus the incident γ-radiation produces a blackening of the film both directly and also via the scintillations produced in the crystal. This system is stated to be 10^3 to 10^4 times as sensitive as the conventional film detector. S.Chomet

539.1.07

4207. PHOTOGRAPHIC METHOD FOR MEGAROENTGEN DOSIMETRY. H.F.Nitka and D.P.Jones.
Nucleonics, Vol. 15, No. 10, 128, 130-3 (Oct., 1957).

The blackening of print-out paper was measured for exposures of 5×10^4 to 4×10^6 r of several types of radiation. Its use as a dosimeter is proposed. R.D.Smith

539.1.07

4208. FAST-TIMING APPARATUS FOR MEASURING THE ARRIVAL DIRECTIONS OF COSMIC-RAY AIR SHOWERS. G.W.Clark.
Rev. sci. Instrum., Vol. 28, No. 11, 907-9 (Nov., 1957).

The apparatus consists of four plastic scintillation detectors in a square array and a fast oscillograph, with which one can determine the relative arrival times of the first shower particles that reach the four detectors, as indicated by the relative positions of pulses from the detectors on the oscillographic sweep. The uncertainty in determinations of the relative arrival times of the particles in a shower is about 3 mμsec. The uncertainty in the determination of the arrival direction of a shower is about ± 5°, and this uncertainty is caused primarily by the lack of coplanarity of the shower particles and not by instrumental limitations. A.

539.1.07

4209. FIELD HOMOGENIZING COILS FOR NUCLEAR SPIN RESONANCE INSTRUMENTATION. M.J.E.Golay.
Rev. sci. Instrum., Vol. 29, No. 4, 313-15 (April, 1958).

The coils described are assembled in two relatively thin flat stacks which are placed on each pole piece of a nuclear spin resonance magnet. One coil of each coil pair is in each of the two stacks, and each coil pair is so designed that the current circulating in it produces, in the airgap centre, a correcting magnetic field describable by one of a set of spherical harmonics. The orthogonal properties of the spherical harmonics render possible substantially independent adjustments of the currents in the several coil pairs, when some spin resonance parameter such as line width is utilized to determine that individual optima are reached. Experimental coil stacks with 13 coil pairs, for the second, third, and zonal fourth harmonics, were constructed, and preliminary results indicate that when a 4 mm spin sample is used, this method can serve to reduce field inhomogeneities to less than 1 part in 10^6 with few sets of 13 current adjustments. A.

ELEMENTARY PARTICLES

539.12

4210. ELEMENTARY PARTICLE REACTIONS. C.O.Beasley, Jr and W.G.Holladay.
Nuovo Cimento Suppl., Vol. 7, No. 1, 77-90 (1958).

An algebra is devised by which all possible reactions of elementary particles, including strange particles, which conserve two quantum numbers "attribute" and "heaviness" [related to the more familiar "strangeness" and "baryon number"] may be written down. Tables are given listing all such processes with up to four particles in the final state, including the calculated energy threshold for each in collisions with a free nucleon or with a nucleon bound in a nucleus. S.J.Goldsack

539.12

4211. THE POLARIZATION–ASYMMETRY EQUALITY. J.S.Bell and F.Mandl.
Proc. Phys. Soc., Vol. 71, Pt 2, 272-4 (Feb., 1959).

This equality, in double-scattering experiments with spin ½ particles, depends on time-reversal invariance alone (previous proofs assumed parity conservation too), provided the incident beam in the asymmetry experiment is transversely polarized, and only transverse polarization is measured in the polarization experiment. R.J.N.Phillips

539.12

4212. THE POLARIZATION–ASYMMETRY EQUALITY. J.S.Bell and F.Mandl.
Proc. Phys. Soc., Vol. 71, Pt 5, 867-8 (May, 1958).

See the preceding abstract. This equality breaks down when the incident beam in the asymmetry experiment has a longitudinal component of polarization, which is possible with parity violation. An experiment is suggested in which this component effectively averages zero. R.J.N.Phillips

539.12

4213. A NOTE ON THE ELASTIC SCATTERING OF RELATIVISTIC PARTICLES IN MATTER IN THE STATIONARY CASE. N.A.Chernikov.
Zh. éksper. teor. Fiz., Vol. 33, No. 2(8), 541-2 (1957). In Russian.

Generalizes the total and angular-differential scattering cross-sections to relativistic particles of arbitrary mass colliding with nuclei which are stationary in the laboratory frame. J.W.Gardner

539.12 : 530.145

SCATTERING BY A POTENTIAL WELL OF SPHERICAL SYMMETRY. See Abstr. 3714

539.12

4214. ON THE STATISTICAL CHARACTER OF PHOTON ABSORPTION. E.Baumgardt.
C.R. Acad. Sci. (Paris), Vol. 245, No. 25, 2236-8 (Dec. 16, 1957). In French.

Experiments with a 20-stage photo-multiplier tube (gain ~ 5×10^7) are described, which when cooled with solid CO_2 gave only about 8 electrons/sec residual current. Using a low incident-light-beam intensity the statistical fluctuations in the emitted electron rates were studied. These fluctuations agree with those theoretically predicted. J.D.Craggs

539.12

4215. ENERGY SPECTRA OF CASCADE ELECTRONS AND PHOTONS. C.A.Olson and L.V.Spencer.
J. Res. Nat. Bur. Stand., Vol. 60, No. 2, 85-96 (Feb., 1958).

The equations for the energy spectra of electrons and photons in a cascade shower are written in a form suitable for numerical applications with accurate cross-sections. Trial calculations were carried out to check the feasibility of an iterative numerical integration procedure similar to that used successfully at low energies in non-cascade problems. Numerical results were obtained for lead by using a mono-energetic source of electrons at 360 mc^2 and extreme relativistic cross-sectional forms, which assume complete screening. The method was designed to permit the determination of cascade-shower spectra, spatial distributions, and directional distributions that are exact in the sense that the main limiting factor is the accuracy with which the cross-sections are known. The numerical results of the trial calculations were found to agree with previously published results based on more restrictive methods of analysis. A.

539.12

4216. A NEW POSSIBILITY IN NEUTRINO THEORY.
A.M.Brodskiĭ and D.D.Ivanenko.
Zh. éksper. teor. Fiz., Vol. 33, No. 4(10), 910-12 (1957). In Russian.

In addition to the usual description of electrons and other fermions by means of second-type spinors, it is suggested that for the neutrino, use can be made of Cartan spinors of the first type with other transformation laws in reflection. Despite the conservation of parity, some of the conclusions are analogous to those drawn from the Yang–Lee theory. A.

539.12

4217. PROPOSED EXPERIMENT BEARING DIRECTLY ON HELICITY OF NEUTRINOS. L.A.Page.
Nuovo Cimento, Vol. 7, No. 5, 727-8 (March 1, 1958).

It is pointed out that none of the experiments performed since the first demonstration of parity non-conservation yields the helicity of the neutrino directly. In K-capture by an unpolarized nucleus leading to a (excited) state of non-zero angular momentum, the final nucleus will in general be polarized with respect to the direction of the emitted neutrino, assuming this to be polarized. The γ-ray, which is subsequently emitted, will then also be polarized, the amount of polarization being correlated with the direction of the photon relative to the neutrino. It is suggested that nuclear resonance fluorescence may be used to select those γ-rays which are emitted opposite to the neutrino, and an analysis of the circular polarization of these photons would directly yield the helicity of the neutrino, assuming, of course, that the spins of the three nuclear states are known. [Exactly this experiment was performed by Goldhaber, Grodzins and Sunyar (Abstr. 2461/1958).]

P.K.Kabir

539.12 : 53.081.6

4218. NOTE ON THE MEASUREMENT OF E/M BY THE HOAG METHOD. Soemitro, S.Prawirowardojo and W.C.Dickinson.
Amer. J. Phys., Vol. 26, No. 5, 316-18 (May, 1958).

The value of e/m obtained by the Hoag method depends critically on the choice of the measuring origin for the distance from the oscilloscope deflecting plates to the screen. The correct origin was determined by solving the equations of motion for the electron trajectories. It is concluded that only a single set of unflared deflecting plates should be present in the oscilloscope tube if accuracy of 1 or 2% is desired. A.

539.12

4219. ON AN EXTENDED STRUCTURE FOR THE ELECTRON.
E.J.Sternglass.
C.R. Acad. Sci. (Paris), Vol. 246, No. 8, 1166-8 (Feb. 24, 1958).
In French.

It is shown that the high-energy electron scattering results of Hofstadter can be explained by assuming an extended charge distribution for the electron, fitted to give a purely electromagnetic rest energy, and a point proton. G.H.Burkhardt

539.12

4220. THEORETICAL PROBLEMS OF AN EXTENDED MODEL OF THE ELECTRON AND THE PROTON. E.J.Sternglass.
C.R. Acad. Sci. (Paris), Vol. 246, No. 9, 1386-9 (March 2, 1958).
In French.

By assuming the existence of a stable extended source, treating as improper the whole question of its structure, certain other well-known difficulties are seen to disappear. G.H.Burkhardt

539.12 : 537.591.15

4221. STATISTICAL FLUCTUATIONS OCCURRING IN ELECTRON-PHOTON CASCADES OF 1000 GeV PRIMARY ENERGY. H.Fay.
Nuovo Cimento, Vol. 6, No. 6, 1516-19 (Dec., 1957).

To determine whether statistical fluctuations can be the explanation of observed deviations of high-energy cascades from the values predicted by theory, the development of 15 cascades was calculated by a Monte Carlo method, based on exact cross-sections for bremsstrahlung and pair production, and taking ionization energy loss into account. Substantial deviations from the theoretical values were found, both in total number of particles and in the energy spectrum.

539.12

4222. MULTIPLE PRODUCTION OF PAIRS IN QUANTUM ELECTRODYNAMICS. L.M.Afrikyan.
Zh. éksper. teor. Fiz., Vol. 33, No. 2(8), 531-2 (1957). In Russian.

The cross-section for the production of two pairs by an electron is calculated in a simple approximation, and the multiple production of pairs by γ-rays is considered in the Weizsäcker–Williams approximation. G.E.Brown

539.12

4223. A RADIOFREQUENCY METHOD TO MEASURE THE MASS OF RELATIVISTIC ELECTRONS. V.N.Lazukin.
Zh. éksper. teor. Fiz., Vol. 33, No. 1(7), 267-9 (1957). In Russian.

With reference to some recent criticism (Janossy and Farago, Review of the experimental evidence for the law of variation of the electrical mass with velocity. Budapest, 1956), a method is suggested to verify the exact form of the relativistic increase of the mass of a charged particle. This might be done by introducing a beam of fast electrons into a resonant cavity placed in an axial magnetic field and fed with radiofrequency waves. By measuring the frequency at which the cyclotron resonance occurs, a very accurate measure of the mass of the electrons should be feasible. Two possible practical ways of doing this are discussed according to the range of the energies of the electrons. G.Martelli

539.12

4224. TIME REVERSAL AND POLARIZATION PHENOMENA IN $N + N \rightleftharpoons d + \pi$ REACTIONS. L.I.Lapidus.
Zh. éksper. teor. Fiz., Vol. 33, No. 1(7), 204-12 (1957). In Russian.

It is shown, by analysing polarization phenomena in $N + N \rightleftharpoons d + \pi$ reactions, how invariancy under time reversal leads to a connection between polarization phenomena in direct and inverse reactions. Wolfenstein's theorem is extended to the case of the binary reaction under consideration. Expressions for various observable quantities in $N + N \rightleftharpoons d + \pi$ reactions are given when only s-, p- and d-waves with $J \leq 2$ are considered, as well as for the general case. A.

539.12

4225. TWO-NUCLEON FORCES AND NUCLEAR SATURATION. R.Karplus and K.M.Watson.
Amer. J. Phys., Vol. 25, No. 9, 641-7 (Dec., 1957).

Brueckner has adduced considerable evidence that the observed proton–proton, proton–neutron, and neutron–neutron forces lead to stable atomic nuclei whose density is independent of their size. The experimental information and the theoretical arguments that lead to this conclusion are reviewed. A.

539.12

4226. ANNIHILATION OF ANTINUCLEONS. V.M.Maksimenko.
Zh. éksper. teor. Fiz., Vol. 33, No. 1(7), 232-7 (1957). In Russian.

The distribution of stars produced in annihilation of nucleon–antinucleon pairs is computed from the number of secondary particles by applying the statistical theory of multiple production of particles. Exact expressions for the statistical weights are used in the calculations, and the laws of conservation of energy, momentum and isotopic spin are taken into account. The calculations are carried out for various magnitudes of the effective volume in which the energy is evolved and for various types of particle created as a result of particle annihilation. The theoretical value of the mean multiplicity of π-mesons (3–5) agrees with available experimental data, whereas the number of K-mesons predicted by the theory substantially exceeds the experimental value. The momentum distribution of secondary π-mesons in the centre of mass system is also computed. A.

539.12

4227. THE ELASTIC SCATTERING OF 380 MeV PROTONS BY PROTONS. I. AT ANGLES GREATER THAN 30° (C.M.).
D.Harting, J.R.Holt and J.A.Moore.
Proc. Phys. Soc., Vol. 71, Pt 5, 770-80 (May, 1958).

The proton–proton differential elastic scattering cross-section

at 380 MeV has been accurately measured over the angular range 30° to 90° (centre of mass system). Coincidences between scattered and recoil protons were counted, using targets of polyethylene and carbon, and the number of incident protons determined with a calibrated ionization chamber. At 90° the differential cross-section is 3.70 ± 0.06 millibarns/sterad and increases at smaller angles to a value 9% greater at 30°. A.

539.12

4228. THE ELASTIC SCATTERING OF 380 MeV PROTONS BY PROTONS. II. AT ANGLES LESS THAN 30° (C.M.).
J.R.Holt, J.C.Kluyver and J.A.Moore.
Proc. Phys. Soc., Vol. 71, Pt 5, 781-8 (May, 1958).

Measurements on the proton–proton differential elastic scattering cross-section at 380 MeV have been made within the angular range 4° to 30° (c.m.). A target of liquid hydrogen was used and a threshold Cherenkov counter was included in the detecting telescope to eliminate particles from inelastic processes. The total cross-section for deuteron production was found to be 0.57 ± 0.08 millibarns. A.

539.12

4229. ON THE SCATTERING OF SLOW NEUTRONS BY HYDROGEN MOLECULES. S.Brimberg.
K. Tekn. Högsk. Avhandl., No. 116, 125 pp. (1956).

A detailed quantum-mechanical treatment of the total cross-section. Thermal motion of the target molecules is taken into account, with three different assumptions for the oscillator modes: rigid rotator, harmonic oscillator and anharmonic oscillator (Morse potential). The formulae are compared with experiment from 0.0033 to 1.1 eV neutron energy. The harmonic oscillator model is the most satisfactory. The n–p scattering lengths are derived, in agreement with previous results. The quantitative effect of thermal motion is found. R.J.N.Phillips

539.12 : 539.2

INELASTIC SCATTERING OF NEUTRONS IN CRYSTALS. See Abstr. 3455

539.12

4230. EXPERIMENT ON THE REFLECTION AND ABSORPTION OF NEUTRONS. R.J.Stephenson and T.F.Samsel.
Amer. J Phys., Vol. 25, No. 9, 632-5 (Dec., 1957).

Fast neutrons from a radium–beryllium source were slowed down in paraffin and detected by a boron trifluoride proportional counter. The absorption of the neutrons in aluminium and their reflection by paraffin blocks were measured using electronic amplifying and counting equipment. A.

539.12

4231. HEAVY MODERATOR APPROXIMATIONS IN NEUTRON TRANSPORT THEORY. H.Amster.
J. appl. Phys., Vol. 29, No. 4, 623-7 (April, 1958).

The flow of neutrons slowing down into a given angular and lethargy (or energy) interval equals an integral over the contributions from neutrons at other angles and lethargies within the medium. The two angular dependences of the integrand are commonly expanded in Legendre polynomials, and for heavy moderators, the lethargy dependence being integrated over is expanded in a power series about the lethargy of the exit neutrons. For each of these three expansions there is an index whose effect on the rate at which the resulting coefficients $T_{LL'}{}^{n}$ vanish with increasing moderator mass is found. These estimates indicate where to terminate the lethargy expansions of the components of the current so as to maintain a consistent order of accuracy for each, and the sensitivity of the approximations to individual Legendre coefficients of the scattering cross-sections follows. Exact recursion formulae derived for the $T_{LL'}{}^{n}$ contain infinite sums, which can be terminated such that the uncertainty in the terms retained in the transport theory approximations are no larger than the estimated values of terms neglected. The familiar "consistent P1 approximation" is generalized as a particular example, and it is shown to be sensitive to only the first three Legendre coefficients of the cross-section. The Greuling–Goertzel approximation is also generalized and its merits noted. The associated difficulties in treating recoil due to inelastic scattering are discussed. A.

539.12

4232. NEUTRON PENETRATION IN INFINITE MEDIA; CALCULATION BY SEMI-ASYMPTOTIC METHODS. S.S.Holland,Jr.
J. appl. Phys., Vol. 29, No. 5, 827-33 (May, 1958).

Application is made of the semi-asymptotic method of Spencer (Abstr. 878/1953) to the penetration and slowing down of neutrons in infinite media. This method can handle complete numerical input data, and is not restricted in distance. Calculations are carrie out for the ideal constant cross-section case, and a 1 keV point source in air. Complete flux spectra for the 1 keV point source are given for distances out to 100 mean free paths. A.

539.12

4233. TOTAL CROSS SECTIONS FOR FAST NEUTRONS BY A TIME OF FLIGHT METHOD.
P.Huijer, C.C.Jonker, J.van den Berg and J.Rethmeier.
Physica, Vol. 24, No. 5, 331-42 (May, 1958).

A time of flight method for the determination of total cross-sections for fast neutrons was achieved by detecting neutrons twice along their path by stilbene scintillation counters. The time interval between the pulses of the two counters is measured by a delayed coincidence circuit and determines the energy of the neutrons between the counters. The experimental arrangement and its properties with respect to efficiency, energy resolution and background are discussed. The time resolution was limited by the low efficiency of the coincidence circuit for resolving times smaller than 4 mμsec. The method was tested by measuring with an average energy resolution of 20% the total cross-section of sulphur between 400 and 1200 keV. The results are compared with earlier measurements and with the optical model. Further possibilities of the method are discussed. A.

539.12

4234. THE CAPTURE OF SLOW NEUTRONS BY PROTONS.
A.R.Baker and D.H.Wilkinson.
Phil. Mag. (Eighth Ser.), Vol. 3, 647-51 (June, 1958).

The result of a new experimental determination of the capture cross-section of protons for slow neutrons is briefly reported. It is $\sigma_H = 0.327 \pm 0.004$ barns and is obtained by a comparison with the absorption of boron for slow neutrons. A survey is presented of various direct and indirect methods for determining the neutron–proton capture cross-section and the final value resulting from their inter-comparison is $\sigma_H = 0.3315 \pm 0.0017$ barns. A.

539.12 : 539.17

4235. NEUTRON PRODUCTION AT HIGH ENERGIES.
W.E.Crandall and G.P.Millburn.
J. appl. Phys., Vol. 29, No. 4, 698-704 (April, 1958).

Neutron yields from several targets bombarded by deuterons, protons, neutrons and He^3 ions with energies of hundreds of MeV were measured by detecting the neutrons with $MnSO_4$ solution. The effect of secondary targets of U and Th in multiplying the primary yield was investigated, and the energy dependence for Be and U targets bombarded by deuterons was measured for energies between 90 and 320 MeV. The data were analysed in terms of the average number of neutrons produced in an inelastic collision; the largest number observed was 17 for 340 MeV protons bombarding U. The data are in reasonable agreement with evaporational theory and Monte Carlo calculations. A.

539.12

4236. DISPERSION RELATIONS FOR INELASTIC SCATTERING. T.W.B.Kibble.
Proc. Roy. Soc. A, Vol. 244, 355-76 (March 25, 1958).

A derivation of the dispersion relations for the inelastic process in which one meson is scattered on a nucleon into several mesons is presented. The case of two outgoing mesons is treated rigorously and in detail. The method used is based on that of Bogolyubov, Medvedev and Polivanov (1956) for non-forward elastic scattering, and a mathematical theorem assumed here is a generalization of a theorem stated by these authors. A.

539.12

4237. THEORY OF MESON MULTIPLE PRODUCTION.
D.Ito and H.Tanaka.
Nuovo Cimento Suppl., Vol. 7, No. 1, 91-116 (1958).

It is shown that the statistical theory of Fermi (Abstr. 3336/1951) and the hydrodynamical theory of Landau (Abstr. 5771/1954)—which seems to give the most satisfactory agreement with the observed multiplicities, angular distributions, and branching ratio of θ^0- and π^0-particles — can both be derived from a statistical treatment of the S-matrix in ordinary field theory. The first corresponds to the production of non-interacting mesons, while the second is obtained if the effects of meson–meson interaction are included. The hypothesis of a thermo-equilibrium state does not appear in the derivations, and the results depend on the distribution of mesons in the proper field of the nucleon. By making a certain choice for this function, a variant of the Fermi theory is obtained, which yields results as good as those of Landau. P.K.Kabir

539.12

238. EFFECTIVE CROSS-SECTION FOR ELECTRON-PAIR REATION BY μ-MESONS. RELATION WITH THE MAGNETIC OMENT. M.Avan and L.Avan.
uovo Cimento, Vol. 6, No. 6, 1500-1 (Dec., 1957). In French.

Thirty further tracks at a water-equivalent depth of 300 m, and hirty one at 580 m, (see Abstr. 754/1957) were analysed for evidence f an anomalous μ-meson magnetic moment (Abstr. 3272/1956, 5642/957). The cross-sections $(0.67 \pm 0.12$ and $0.86 \pm 0.16) \times 10^{-25}$ cm^2 er nucleus of emulsion respectively) agreed with the theoretical habha values for a Dirac spin-½ particle of normal magnetic oment; the upper limit for the departure from normal can be set t 10%.

539.12

239. NON-CONSERVATION OF PARITY IN THE RADIATIVE -MESON DECAY. G.W.Bund and P.Leal Ferreira.
uovo Cimento, Vol. 7, No. 2, 246-8 (Jan. 16, 1958).

The radiative decay of the π-mesons ($\pi^{\pm} \rightarrow \mu^{\pm} + \nu + \gamma$) s recalculated in lowest-order perturbation theory, using the two-omponent theory of the neutrino. If the polarization of the photon s not observed, parity non-conservation does not change earlier esults (Abstr. 2737/1953) on the correlation between the muon and ne light quantum, but if the state of circular polarization is detected, ne (γ,μ) correlation function now depends on the polarization of the hoton as well. P.K.Kabir

539.12

240. ELASTIC SCATTERING OF PIONS AT A BOUND UCLEON. E.W.Laing.
roc. Phys. Soc., Vol. 71, Pt 6, 932-8 (June, 1958).

In the approximation of the single-nucleon model for the nucleus, ne effect of nuclear binding on pion–nucleon scattering is estimated sing a variational method and neglecting nucleon recoil in inter-ediate states. Results are compared with those of a simple p-ave phenomenological theory. Similar cross-sections are obtained xcept in the region of the p-wave resonance of free nucleon–pion cattering, where the phenomenological theory leads to a cross-ection an order of magnitude smaller. This result is unaffected hen nucleon recoil is taken into account, but may be sensitive to the noice of trial wave-functions used in the variational calculation. A.

539.12 : 530.145

SCATTERING OF PIONS BY NUCLEONS. See Abstr. 3717

539.12

241. A RESONANCE MODEL FOR PION PRODUCTION IN UCLEON–NUCLEON COLLISIONS AT FAIRLY LOW ENERGIES. .Mandelstam.
roc. Roy. Soc. A, Vol. 244, 491-23 (April 22, 1958).

Cross-sections for pion production in nucleon–nucleon col-sions are calculated on the assumption that the production takes lace into a few angular-momentum states only, and that the matrix ement for each particular transition is constant except for factors ue to the final-state pion–nucleon and the nucleon–nucleon inter-tions. The outgoing pion is assumed to be in a resonant (3/2, 3/2) ate with one of the nucleons. The angular-momentum states troduced are compared with those of Rosenfeld (Abstr. 11450-1/1954) d Gell-Mann and Watson (Annual Review of Nuclear Science, ol. 4, 219, 1954). It is found that a three-parameter theory can ve a good account of most of the experiments on pion production, th total and differential, up to 660 MeV, except near threshold ien non-resonance production is important and further parameters e necessary. Energy distribution and angular correlation experi-ents bring out the importance of the pion–nucleon resonance. The oss-section for neutral pion production is predicted fairly accur-ely in terms of that for positive pion production from threshold 660 MeV; at 660 MeV, the calculated positive/neutral ratio is 3.9. ue difference between this value and that of Peaslee (Abstr. 8670, 449/1954) is partly due to the mass different between the positive d neutral pion and partly to the inclusion of interference effects tween the outgoing nucleons. A.

539.12 : 539.17

42. PRODUCTION OF HEAVY MESONS AND HYPERONS, ITH A COMMENT ON DISPERSION RELATIONS. M.K.Polivanov.
okl. Akad. Nauk SSSR, Vol. 118, No. 4, 679-82 (1958). In Russian.

Reviews various types of nuclear disintegrations in which K and particles are produced; proposes a general formulation of the spersion relations encompassing all such disintegrations. J.W.Gardner

539.12

4243. A POSSIBLE CASE OF DECAY OF A τ'-MESON WITH EMISSION OF AN ELECTRON–POSITRON PAIR. A.A.Nomofilov.
Dokl. Akad. Nauk SSSR, Vol. 118, No. 1, 59-60 (1958). In Russian.

The event was found in an emulsion stack exposed in a strato-spheric flight, and is described in some detail. The suggested scheme of decay is $\tau' \rightarrow \pi^+ + \pi^0 + \pi^0$, where one π^0 decays into $\gamma + e^+ + e^-$. G.Martelli

539.12

4244. POLARISATION OF μ-MESONS AND ELECTRONS IN K-MESON DECAYS. J.Werle.
Nuclear Phys., Vol. 4, No. 1, 171-82 (Aug., 1957).

The longitudinal polarization of the μ-mesons and electrons emitted in $K \rightarrow \pi + \nu + \mu$ (or e) is investigated under the assumption that the neutrino is completely polarized in the direction parallel to its direction of motion. The general form of the S-matrix containing four coupling types is taken into account. It is found that the polar-ization as a function of the energy depends in a very sensitive way on the type of coupling. This may provide a new powerful tool for the investigation of the form of coupling. A.

539.12

4245. METHOD FOR DETERMINING THE K_+^0–K_-^0 MASS DIFFERENCE. M.L.Good.
Phys. Rev., Vol. 110, No. 2, 550-1 (April 15, 1958).

The equations of motion for the amplitudes of short-lived (K_+^0) and long-lived (K_-^0) neutral K-mesons in an absorber are simplified for the case of dominance of the decay term. For the case of a thick absorber, a simple relation between the intensities of scattered and unscattered regenerated K_+^0, at zero degrees, results; the relation is sensitive to the K_+^0–K_-^0 mass difference. A.

539.12

4246. PARITY OF THE K MESON FROM A DISPERSION RELATION. C.Goebel.
Phys. Rev., Vol. 110, No. 2, 572-3 (April 15, 1958).

It is remarked that the forward dispersion relations for $K^{\pm}$-nucleon scattering offer a determination of the "strong interaction parity" of the K meson. At present, the sign of the parity, determined in this way, depends on one uncertain experimental datum: the sign of the K^-–p scattering length. A.

539.12

4247. K-MESON DISPERSION RELATIONS. I. THEORY.
P.T.Matthews and A.Salam.
Phys. Rev., Vol. 110, No. 2, 565-8 (April 15, 1958).

Dispersion relations for K-meson scattering are considered, particularly for the theoretical difficulties of contributions from a continuum in the unphysical region. Some general results relating to threshold values of matrix elements for creation processes in K^- + N collisions are proved. A.

539.12

4248. K-MESON DISPERSION RELATIONS. II. APPLICATIONS.
P.T.Matthews and A.Salam.
Phys. Rev., Vol. 110, No. 2, 569-72 (April 15, 1958).

The present experimental data on K^+ and K^- scattering on protons are used in the dispersion relations of Pt I (preceding abstract). The Λ and Σ parities are assumed to be both positive and the K^+–p potential is taken to be repulsive. The dispersion relations then indicate that an attractive K^-–p potential implies pseudoscalar K mesons, and a repulsive K^-–p potential implies scalar K-mesons. In both cases the coupling constants are of the order of unity. If data on K–n scattering were available it would not be necessary to assume the relative parity for Λ and Σ hyperons, but this could also be determined from the dispersion relations. A.

539.12

4249. STUDY OF THE ABSORPTION OF K^- MESONS AT REST IN NUCLEAR EMULSION. G.L.Bacchella, A.Berthelot, A.Bonetti, O.Goussu, F.Lévy, M.René, D.Revel, J.Sacton, L.Scarsi, G.Tagliaferri and G.Vanderhaeghe.
Nuovo Cimento, Vol. 8, No. 2, 215-46 (April 16, 1958). In French.

The results of the analysis of 391 events of K^- absorption at rest in a large emulsion stack exposed to the Berkeley Bevatron are reported. Scanning "along the track" was used, in order to obtain unbiassed frequencies for the various types of particles. A detailed discussion of the identification of charged hyperons is presented. The findings of previous workers on the features of the observed

$\Sigma^{\pm}\pi^{\mp}$ pairs, and their respective rates of observation, are confirmed. Three absorptions on free protons were observed. Several examples of fast Σ-hyperons unaccompanied by charged π's provide direct evidence for two-nucleon absorptions: they account for ~ 2.5% of the total number of events. Direct production of Λ^0-hyperons is inferred from the observation of fast π-mesons; in addition, hyperfragments associated with 3% of the events indicate production of Λ^0's either directly of via decay of interaction of Σ's. Among the pions whose sign was recognized (40% of the total), the negative ones were found to be more frequent than the positive by a factor of about 3. Evidence for the nuclear reabsorption of hyperons and pions is provided by the study of the visible energy release associated with the absorptions. Some 60% of the events do not contain charged unstable particles: a fair number (~17%) of these events are accompanied by protons of kinetic energy greater than 60 MeV, a fact which suggests the intervention of two-nucleon reactions.

A.

539.12

4250. NUCLEAR POTENTIAL FOR τ^+-MESONS.
T.G.Lim and S.J.Bosgra.
Nuovo Cimento, Vol. 8, No. 2, 340-4 (April 16, 1958).

An analysis of the elastic scattering of τ^+-mesons in G5 nuclear emulsion shows that the nuclear potential by which the τ^+-mesons are scattered is repulsive and that its value is higher than 13 MeV. A.

539.12

4251. ON THE PROCESSES WITH PARTICIPATION OF ANTI-HYPERONS. D.Amati and B.Vitale.
Zh. éksper. teor. Fiz., Vol. 33, No. 2(8), 556-8 (1957).
In Russian.

Since the 10 Gev proton accelerator has recently started working in the Soviet Union, some processes involving anti-hyperons, which might be worth investigating, are briefly reviewed and discussed. G.Martelli

539.12

4252. OBSERVATION OF PRODUCTION, DECAY, AND INTERACTION OF STRANGE PARTICLES.
H.Blumenfeld, W.Chinowsky and L.M.Lederman.
Nuovo Cimento, Vol. 8, No. 2, 296-315 (April 16, 1958).

The operation of the Columbia 36 in. magnet cloud chamber at the Cosmotron is described. The production of unstable particles by 1.9 GeV π^- pions in lead and carbon is studied. The yields are interpreted in terms of nuclear interactions of Λ^0 and θ^0 particles in the nucleus of production. A large cross-section for the reaction $\Sigma^- \rightarrow \Lambda^0$ is deduced from this and other data. The disappearance of θ^0 is observed in lead relative to carbon, and possible mechanisms are discussed. The Λ^0 lifetime is redetermined to be $(2.75^{+0.45}_{-0.40}) \times 10^{-10}$ sec; that of the θ^0 is found to be $(1.15^{+0.40}_{-0.25}) \times 10^{-10}$ sec. Associated production is discussed and an upper limit for the fraction of Λ^0's associated with unknown particles is found to be 0.40. Correlation angles in Λ^0 decay are observed to favour "front-to-back" asymmetry. Some anomalous events are described. A.

539.12

4253. ON THE EXISTENCE OF A PARTICLE OF MASS ~ 525 m_e.
N.Basu and M.S.Sinha.
Sci. and Culture, Vol. 23, No. 9, 496-8 (March, 1958).

Nine selected tracks in a multiplate cloud chamber were measured. Five were assigned masses between 421 and 589 m_e (mean 528 ± 34). The other four appeared to be pions, with masses between 254 and 322 m_e (mean 280 ± 21), and give some idea of the reliability of the estimations. E.J.Burge

NUCLEUS

539.14

4254. ON THE STRUCTURE OF ATOMIC NUCLEI. A.Bohr.
Amer. J. Phys., Vol. 25, No. 8, 547-53 (Nov., 1957).

A survey is given of interpretations of nuclear properties based on the two differing models of nuclear structure: the liquid-drop model and the shell model. These can be considered to be two approximate representations of a structure that is more complex than either. A more comprehensive model is discussed and shown to facilitate interpretation and correlation of the ellipticities of some nuclei indicated by the hyperfine structure of spectra, of rotational gamma ray spectra, and of the process of Coulomb excitation. A.

539.14

4255. STATISTICAL TENSORS FOR ORIENTED NUCLEI.
M.E.Rose.
Phys. Rev., Vol. 108, No. 2, 362-5 (Oct. 15, 1957).

Some properties of the statistical tensors, which govern the angular distribution of radiation emitted by oriented nuclei, are discussed. The discussion is limited to the case of axial symmetry in the spin-Hamiltonian which produces the orientation. An identification of the irreducible tensors, which define the statistical tensors, with those familiar in spin coupling is made. This also permits the matrix elements of the former tensors to be obtained quite easily. The temperature dependence of the statistical tensors for the case of small spin coupling is discussed. A.

539.14 : 536.48

4256. ON THE QUESTION OF THE POSTULATE OF SUPERFLUIDITY IN THE THEORY OF NUCLEAR MATTER.
N.N.Bogolyubov.
Dokl. Akad. Nauk SSSR, Vol. 119, No. 1, 52-5 (1958). In Russian.

The postulate that nuclear matter be a superfluid implies certain limitations on nuclear forces; conversely a macroscopic superfluid can be expressed as a condensed assembly of particles having short-range "nuclear" interactions. These results are exemplified in terms of the Hamiltonian and density matrix formulation for both models. J.W.Gardner

539.14 : 539.17

4257. SCATTERING AND POLARIZATION OF PROTONS BY NUCLEI. H.A.Bethe.
Ann. Phys. (New York), Vol. 3, No. 2, 190-240 (Feb., 1958).

The relation of the polarized scattering of protons by complex nuclei to that by nucleons is investigated quantitatively. No model of nuclear forces is used but the nucleon–nucleon scattering is directly represented by phase shifts. The agreement is found to be good for all the phase-shift solutions which Stapp et al. have given for the proton–proton scattering, the deviation being from 0 to 25%. Thus the scattering by a complex nucleus can be obtained by superposition of the nucleon–nucleon scattering amplitudes. For the purpose of this comparison, the experimental data of Chamberlain et al. on the scattering and polarization of protons by carbon at small scattering angles are analysed directly, i.e. the relevant scattering lengths are deduced from the experimental data, rather than the data synthesized from an assumed potential. The resulting nuclear absorption coefficient reproduces the observed inelastic scattering. The real part of the central potential is found to be attractive but very weak (about 4 MeV). The spin–orbit potential agrees with the nucleon–nucleon data and with some, but not all, previous theoretical values; it is only one-sixth of that required in the shell model. The analysis is facilitated by a theorem, first derived by Köhler and by Levintov, that the polarization is given correctly by the Born approximation. Simple formulae are given to obtain the Born approximation scattering (and thus the potential) from the observed scattering. A particularly simple formula relates the Born approximation scattering to the nucleon–nucleon scattering. The expressions for the relevant amplitudes in nucleon–nucleon scattering are also simplified. It is further shown that the scattering matrix for nucleon–nucleon scattering at a given angle can be completely determined if all the standard triple scattering and polarization experiments are carried out. A.

539.14

4258. PROPERTIES OF NUCLEAR MATTER.
L.C.Gomes, J.D.Walecka and V.F.Weisskopf.
Ann. Phys. (New York), Vol. 3, No. 3, 241-74 (March, 1958).

An account is given of recent theories by Brueckner, Eden, Swiatecki, Bethe, and co-workers about the properties of nuclear matter, which is identical in content, but different in its method of presentation. This presentation tries to clarify the reasons for the applicability of the independent-particle model and to determine what particular features of the nuclear forces are responsible for the validity of this model. A.

539.14 : 539.17

4259. THE STUDY OF NUCLEAR COLLECTIVE MOTION BY STRIPPING REACTIONS. G.R.Satchler.
Ann. Phys. (New York), Vol. 3, No. 3, 275-91 (March, 1958).

The "intrinsic" probability for capture of nucleons is studied for nuclei which exhibit collective vibrations or rotations in addition to an underlying shell structure of independent nucleon orbits. Such probabilities or reduced widths for low-lying nuclear levels can be measured in "direct" nuclear reactions; the present dis-

cussion is formulated chiefly in terms of deuteron stripping. Various selection rules are derived, and possible reasons for their breakdown studied. It is found that stripping is a particularly direct way of studying the wave-functions of single particle orbits in strongly deformed nuclei. There are simple branching ratios between the capture probabilities into the various members of a rotational band in such nuclei. Finally, it is shown how such reduced-width measurements can provide an independent check on the wave-functions postulated by Osborn and Klema to correlate empirically the ground-state properties of nuclei. A.

539.14

4260. CONNECTION BETWEEN THE NUCLEAR SHELL MODEL AND THE UNIFIED MODEL. S.A.Moszkowski.
Phys. Rev., Vol. 110, No. 2, 403-26 (April 15, 1958).

The main point of this paper is to discuss the connection between the unified model and a modified form of the nuclear shell model. In the latter, the effective interactions between nucleons, i.e. those not included in the central average potential, are assumed to be factorable. It can be argued that inside nuclear matter the Pauli principle greatly suppresses the off-diagonal effects of the interactions, i.e. it prohibits most inelastic collisions; so that the nucleons move nearly freely within the nucleus, at least as far as low-energy phenomena are concerned. Short-range correlations due to the interactions are not suppressed, but these are expected to manifest themselves at rather high energies. According to this view, the effective interactions between nucleons occur mainly at the nuclear surface and give rise to surface oscillations. While quadrupole oscillations predominate, higher modes also arise in a natural way. Under certain conditions, the problem of particles subject to mutual interactions may be solved by introduction of additional collective variables, which is the method of the unified model. Physically, the nuclear motion separates, at least approximately, into intrinsic and collective motions. The resulting wave functions are very similar to the ones used by Bohr and Mottelson, except that they are integrated over the collective variables. Also, the energy spectra are of the form obtained by Bohr and Mottelson, but the collective excitation spetcurm is cut off, i.e. only a finite number of states occur. This method is applied to a simplified two-dimensional nuclear model. The particles are assumed to move in an isotropic harmonic oscillator potential, and to be in addition subject to (a) one-body spin-orbit forces, and (b) mutual quadrupole–quadrupole interactions. In the absence of spin–orbit coupling, the spectrum separates into a series of rotational bands, while in the absence of mutual interactions we have an independent-particle spectrum. The intermediate coupling problem is also treated in the hope that it may provide some insight into the competition between independent-particle and collective motions in nuclei. In the present example, the transition between the two limiting schemes occurs quite suddenly, in agreement with the experimental evidence. Another case of interest is the situation at the beginning of the nuclear 1p shell. In the limit of pure LS coupling, the states of maximum spatial symmetry form a rotational band, though only very few members can appear, and collective effects are not pronounced, because of the small number of particles involved. The effect of spin–orbit coupling can also be described in the language of the unified model. A.

539.14

4261. THEORY OF FINITE NUCLEI.
K.A.Brueckner, J.L.Gammel and H.Weitzner.
Phys. Rev., Vol. 110, No. 2, 431-45 (April 15, 1958).

A theory of finite nuclei is formulated, based on the reaction-matrix theory of the nuclear many-body system. The reaction matrix appropriate to the finite nucleus is in the exact theory determined by the solution of coupled Hartree–Fock and reaction-matrix self consistency problems. This formal procedure is extremely difficult to carry out; the finite-nucleus reaction matrix has instead been approximated by the reaction matrix appropriate to the local density, which is a nonlocal coordinate space operator $(r|K|r')$. It is shown that this approximation is equivalent to the assumption that a finite nucleus has the same short-range correlation structure as nuclear matter. The formalism used to determine $(r|K|r')$ from the results previously obtained in the study of nuclear matter is derived, and the methods used in explicit evaluation are described. The numerical results discussed are based on the phenomenological two-body potentials of Gammel and Thaler which give an excellent description of all scattering data up to 300 MeV. The operator $(r|K|r')$ obtained shows marked nonlocality for r and r' less than 10^{-13} cm. That this is largely associated with the repulsive cores in the potentials is shown by a simple analytic approximation to $(r|K|r')$. The nonlocality is further enhanced in the triplet states by the effects of the noncentral forces which lead to marked l-dependence in the even states. The reaction matrix so determined contains a large spin–orbit term. It is shown that this is almost entirely due to the spin–orbit two-body potential and that the tensor forces give only a very small contribution. Proceeding from the reaction matrix as an effective two-body interaction, the Hartree–Fock problem is formulated taking into account the complicated exchange and nonlocal character of the reaction matrix. A general result is obtained for the single-particle spin–orbit potential which is shown in the case of a local interaction to reduce approximately to the form of the Thomas interaction. An iteration method is proposed for solving the single-particle eigenvalue problem with a nonlocal potential which reduces the differentio-integral equation characteristic of the theory to an ordinary differential equation. This procedure requires the introduction of a linear derivative term in the differential equation. The method is exact in the limit of convergence of the iteration method or if the nonlocal potential is replaced by a local approximation. A.

539.14

4262. SIMILARITY BETWEEN SHELL-MODEL AND DEFORMED-NUCLEUS WAVE FUNCTIONS. M.G.Redlich.
Phys. Rev., Vol. 110, No. 2, 468-76 (April 15, 1958).

A body coordinate system x'y'z' is defined in which the density of nuclear matter is assumed axially symmetric about the z' axis, the angular momentum $j_{z'}$ of each of the A nucleons in the nucleus about this axis being quantized. The wave-function of a nucleon is φ_K, with $j_{z'}\varphi_K = \kappa\varphi_K$. The system x'y'z' is rotated relative to a system xyz fixed in space in such a way that the nucleus is in a state of total angular momentum J, with z component M, while the z' component remains $K = \kappa_1 + \ldots + \kappa_A$. The nuclear wave-function is Ψ_{MK}^{J}. The φ_K are so defined that the Ψ_{MK}^{J} are similar to wave-functions obtained for shell-theoretical calculations. In order to represent at least 13 low states with A = 18 and 19, three φ_K are needed. These φ_K resemble χ_K, the wave-functions of particles in a slightly deformed harmonic-oscillator well. Calculated ft values and magnetic moments are also similar to those for shell theory. A.

539.14

4263. A THEOREM ON THE SINGLE PARTICLE ENERGY IN A FERMI GAS WITH INTERACTION. N.M.Hugenholtz and L.van Hove.
Physica, Vol. 24, No. 5, 363-76 (May, 1958).

Investigates single-particle properties in a Fermi gas with interaction at the absolute zero of temperature. In such a system a single-particle energy has only a meaning for particles of momentum $|k|$ close to the Fermi momentum k_F. These single-particle states are metastable with a life-time approaching infinity in the limit $|k| \to k_F$. The limiting value of the energy is called the Fermi energy E_F. As a special case of a more general theorem, it is shown that for a system with zero pressure (i.e. a Fermi liquid at absolute zero) the Fermi energy E_F is equal to the average energy per particle E_o/N of the system. This result should apply both to liquid He_3 and to nuclear matter. The theorem is used as a test on the internal consistency of the theory of Brueckner (Abstr. 3451/1955) for the structure of nuclear matter. It is seen that the large discrepancy between the values of E_F and E_o/N, as calculated by Brueckner and Gammel, arises from the fact that Brueckner neglects important cluster terms contributing to the single-particle energy. This neglect strongly affects the calculation of the optical potential. A.

539.14

4264. FORMATION OF AN ALPHA-GROUP IN THE SHELL-MODEL OF A HEAVY NUCLEUS. C.Strachan.
Proc. Cambridge Phil. Soc., Vol. 53, Pt 2, 494-507 (April, 1957).

By means of a variation principle applied to a nuclear wave-function for four nucleons in the field of a closed core, equations are derived giving the relative proportions of a component describing an alpha-particle group and components describing the four nucleons in shell-model states with spin–orbit coupling wave-functions, the two neutron states and the two proton states each paired to give zero resultant angular momentum. Numerical calculations, taking into account only $1h_{9/2}$ states for protons and the $2g_{9/2}$ states for neutrons, give the alpha-group wave-function a relative weight (in the linear combinations) of about 1%. A.

539.14

4265. ROTATION OF ELONGATED ATOMIC NUCLEI.
D.R.Inglis.
Amer. J. Phys., Vol. 26, No. 2, 82-8 (Feb., 1958).

539.14

4266. RELAXATION PROCESSES IN A COUPLED SPIN SYSTEM. I.V.Aleksandrov.
Dokl. Akad. Nauk SSSR, Vol. 118, No. 4, 675-8 (1958). In Russian.

The theory of nuclear paramagnetic relaxation is extended to include spin coupling. When the coupled spins belong to adjacent levels the change in occupation number and transition probability can be expressed as a closed formula involving the spin interactions.
J.W.Gardner

539.14

4267. NUCLEAR SPIN OF GALLIUM-68.
J.C.Hubbs, R.Marrus and J.L.Worcester.
Phys. Rev., Vol. 110, No. 2, 534-5 (April 15, 1958).

The atomic-beam magnetic resonance method was used to measure the nuclear angular momentum of 68-min Ga^{68}. It is found that $I = 1$. A.

539.14

4268. SPIN AND QUADRUPOLE MOMENT OF I^{125} AND THE MAGNETIC MOMENT OF I^{131}. P.C.Fletcher and E.Amble.
Phys. Rev., Vol. 110, No. 2, 536-43 (April 15, 1958).

The spin and quadrupole moment of I^{125} were determined by observations on the microwave absorption spectrum of CH_3I^{125}. Five absorption lines were observed which fit the quadrupole hyperfine pattern of the $J = 2 \leftarrow 1$ rotational spectrum. The measurements indicate a spin of 5/2 and a quadrupole coupling constant of -2179 ± 1 Mc/s. Using this and other known properties of the CH_3I molecule, the quadrupole moment of I^{125} is calculated to be -0.66×10^{-24} cm^2. This spin and quadrupole moment suggest a nuclear configuration for I^{125} similar to that of stable I^{127}, i.e., predominantly $d_{5/4}$. The magnetic moment of I^{131} was measured by observation of the Zeeman splitting of the $F = 9/2 \leftarrow 9/2(K = 1)$ hyperfine line of the $J = 2 \leftarrow 1$ rotational spectrum of CH_3I^{131}. The magnetic moment is found to be 2.56 ± 0.12 nuclear magnetons. The observations also confirm the previous results of Gordy et al. for the spin of I^{131} of $\frac{7}{2}$ and quadrupole coupling constant, $eqQ = -974 \pm 1$ Mc/s. The magnetic moment measurement suggests a ground-state configuration similar to that of I^{129} which is predominantly $g_{7/2}$ in nature but with large admixture of other states. The significance of these results is discussed. A.

539.14

4269. THE MAGNETIC DIPOLE AND ELECTRIC QUADRUPOLE MOMENTS OF DYSPROSIUM 161 AND 163. J.G.Park.
Proc. Roy. Soc. A, Vol. 245, 118-27 (May 6, 1958).

Paramagnetic resonance was observed at 4.2°K and a wavelength of 3.1 cm in magnetically dilute crystals of the acetate and double magnesium nitrate of dysprosium. Values for the nuclear spins and nuclear magnetic dipole moments of the odd isotopes Dy^{161} and Dy^{163} were deduced from the spectrum in dysprosium acetate, although the spectrum does not have axial symmetry and cannot be analysed in detail. More reliable values for these moments were obtained from the spectrum of dysprosium double nitrate, which has axial symmetry. It was also possible to make an approximate calculation of the electronic ground state of dysprosium ions in this salt and estimate the nuclear electric quadrupole moments. The values of the moments are: $\mu^{161} = -0.37 \pm 0.04$ n.m.; $\mu^{163} = +0.51 \pm 0.06$ n.m.; and in units of 10^{-24} cm^2, $Q^{161} = +1.1 \pm 0.4$; $Q^{163} = +1.3 \pm 0.4$. For each isotope, only the relative signs of the two moments were determined experimentally; the signs quoted above are suggested as the most probable ones. A.

539.14

4270. QUADRUPOLE MOMENTS OF As^{75}, La^{139}, AND Hg^{201}. K.Murakawa.
Phys. Rev., Vol. 110, No. 2, 393-6 (April 15, 1958).

It is shown that the level $5d^34s\ ^5F_1$ of Ta II is approximately free from perturbation, making the calculation of the quadrupole moment simple. Then it is shown that the quadrupole coupling constant (measured by Brown and Tomboulian) in the hyperfine structure of this level can be interpreted if one assumed a rather large antishielding effect $\Delta(5d^34s) = -0.77$. In the course of the calculation the magnetic moment $\mu(Ta^{181}) = 2.4 \pm 0.2$ n.m. was obtained. Upon assuming the shielding corrections $\Delta(5d6s) = -0.3$ and $\Delta(6s6p) = -0.1$ for any heavy element around Lu, the quadrupole moments $Q(La^{139}) = 0.2_1 \pm 0.04$ barn and $Q(Hg^{201}) = 0.4_8 \pm 0.04$ barn were obtained. In the case of Lu II $5d4f\ ^3D_1$, a negative (instead of positive) quadrupole moment was obtained by neglecting the shielding correction. This can be interpreted by assuming a large antishielding effect in the 4f electron. In connection with this a tentative value $Q(Er^{167}) = 4$ barns was deduced. Upon assuming $\Delta(4p5s) = -0.16$ for the h.f.s. of the spectrum of As II, the value $Q(As^{75}) = 0.27 \pm 0.04$ barn was obtained. From the h.f.s. of a level of the configuration 4p5p of As II, the value 0.12 ± 0.07 barn was obtained, the shielding correction being neglected; and this is interpreted to be due to a possible large antishielding effect in the 5p electron. The same tendency seems to be detectable in the published determination of $Q(K^{39})$ from the 5p state of K I. A.

539.14

4271. EMPIRICAL DETERMINATION OF NUCLEAR SHAPE FACTORS AND MOMENTS OF INERTIA.
E.D.Klema and R.K.Osborn.
Nuclear Phys., Vol. 3, No. 4, 571-84 (June, 1957).

The results of certain experiments sensitive to nuclear shapes are correlated in terms of the kinematical model used previously for the correlation of nuclear ground-state properties (Abstr. 6450/1957). The data considered are the energies of the rotational levels of even nuclei, (i.e. nuclei with even numbers of protons and neutrons), the probabilities of electrodynamically-induced transistions between these levels, and the quadrupole moments of odd-mass nuclei. The dynamics of the system represented by the model is treated purely empirically and is presumed to be characterized by a small set of well-defined physical paramters. The principal empirical conception investigated is that of the fraction of nuclear matter which participates in collective rotational motion, and its implications for the correlation of nuclear shapes as determined from the data mentioned above. This fraction is taken to be the ratio of the number of particles outside of filled major shells (both protons and neutrons) or the number of holes, whichever is smaller, to the total number of particles in the nucleus. The correlation obtained suggests the possibility of estimating the quadrupole moments of odd-mass nuclear ground states from the superior experimental data on neighbouring even-nuclei, and this suggestion is pursued where possible. It is found that the moments so calculated exhibit no consistent deviations from the experimental values. A.

539.14 : 539.163

4272. POSSIBLE VIBRATIONAL LEVELS IN Dy^{160}. O.Nathan.
Nuclear Phys., Vol. 4, No. 1, 125-44 (Aug., 1957).

The radiations of Tb^{160} (internal conversion, β-ray and γ-ray spectra; γ-γ coincidences) were studied by means of magnetic and scintillation spectrometers and various coincidence techniques. A decay scheme for Tb^{160} has been proposed which includes the following excited stated in Dy^{160}: 87 keV (2+), 283 keV (4+), 964 keV (2+), 1047 keV (3+), 1262 keV (2−), and 1359 keV (3−). The level scheme is discussed in the light of the unified model and it is suggested that the states at 964 keV and 1047 keV may possibly belong to a rotational band associated with electric quadrupole vibrations (gamma vibrations) and that the states at 1262 keV and 1359 keV similarly may belong to a rotational band associated with electric octupole vibrations. A.

539.14

4273. NUCLEAR STRUCTURE OF Zr^{90}. N.H.Lazar, G.D.O'Kelley, J.H.Hamilton, L.M.Langer and W.G.Smith.
Phys. Rev., Vol. 110, No. 2, 513-19 (April 15, 1958).

Beta- and gamma-ray spectroscopy, utilizing both single and coincident NaI(Tl) crystals and a magnetic spectrometer, was used to study the radiations from Nb^{90}. The positron spectrum was resolved into components of 1.505 and 0.655 MeV; the internal-conversion electron spectrum was obtained, from which gamma-ray transitions of 0.132, 0.141, 0.372, 1.13, and 2.34 MeV were determined. The internal-conversion electron spectrum characteristic of the 1.76 MeV monopole transition in Zr^{90} was also seen. The scintillation gamma-ray spectrum was resolved into components of 2.32, 2.19, 2.0, 1.85, 1.60, 1.48, 1.27, 1.13, 1.1, 0.89, 0.372, (0.43), 0.142, 0.133 MeV. Based on these data, a level scheme for Zr^{90} is formulated with excited states at 1.76(0+), 2.19(2+), 2.32(5−), 3.08(4+), 3.45(6+), 3.59(8+), 4.44, 5.05, and 5.45 MeV, and may be qualitatively understood in terms of an independent-particle model. A.

539.14

4274. FINE STRUCTURE IN THE α-DECAY OF ODD NUCLEI. V.G.Nosov.
Zh. éksper. teor. Fiz., Vol. 33, No. 1(7), 226-31 (1957). In Russian.

Excitation of rotational levels in the α-decay of non-spherical odd nuclei is considered. A.

539.14

4275. THE HALF LIFE OF THE FIRST ROTATIONAL LEVEL IN Ra^{226}. H.Vartapetian and R.Foucher.
C.R. Acad. Sci. (Paris), Vol. 246, No. 6, 939-42 (Feb. 10, 1958).

In French.

The half-life of the 67.8 keV excited state in Ra^{226} was measured as $6.3 \pm 0.7 \times 10^{-10}$ seconds by observing the delayed $\alpha-\gamma$ coincidences in the decay of Th^{230}. The quadrupole moment of the Ra^{226} nucleus is calculated to be $7.1 \pm 0.5 \times 10^{-24}$ cm^2 on the assumption that this level is the first rotational level; this value is of the same order as that deduced by Mottelson and Nilson from unified field theory. The electrical field gradients in the region of the Ra nuclei can be estimated as $(\partial^2 V/\partial Z^2) = 3 \times 10^{18}$ V/cm^2 by considering the present half-life measurements in conjunction with the $\alpha-\gamma$ angular correlation measurements of Valladas et al, (Abstr. 4903/1955), and Temmer and Wyckoff (Abstr. 1634/1954).

A.E.I. Research Laboratory

539.14 : 539.163.1

4276. THE HALF-LIFE OF 50 keV E1 RADIATION AND OF THE 286 keV LEVEL IN Ra^{223} (AcX). H.Vartapetian.
C.R. Acad. Sci. (Paris), Vol. 246, No. 11, 1680-3 (March 17, 1958).
In French.

Delayed $\alpha-\gamma$ and $\gamma-\gamma$ coincidence measurements using a source of Th^{227} show the half-life of the 286 keV level to be $(7.7 \pm 0.7) \times 10^{-10}$ sec and that of the 50 keV radiation to be $(6.3 \pm 0.7) \times 10^{-10}$ sec. This latter is about 10^3 times greater than the single-particle value for this E1 γ-ray. M.A.Grace

539.14

4277. INVESTIGATION OF NUCLEAR ISOMERISM IN Hf^{180m}. V.S.Gvozdev, L.I.Rusinov, Yu.I.Filimonov and Yu.L.Khazov.
Nuclear Phys., Vol. 6, No. 4, 561-74 (April [2], 1958).

The coefficient of internal conversion of the 57.6 keV transition in the L-shell of Hf^{180m} was measured and found to be $\alpha_L = 0.33 = 0.10$. The γ-transition is shown to be of the E1 type. A 501.2 keV γ-transition has been detected; measurements of the internal conversion coefficient yield $\alpha_K = 0.035 \pm 0.014$. The 501.2 keV γ-transition is of the E3 type. The level with an excitation energy 1142.9 keV was found to possess a spin 9 and negative parity. The experimental lifetimes for the 57.6 keV and 501.2 keV γ-transitions exceed those predicted by the single-particle model by respectively 10^{16} and 10^9 times. This large discrepancy is due to the high forbiddenness of the γ-transitions with respect to the quantum number K. Internal conversion coefficients have also been measured for γ-transitions of 93.3 keV, 216 keV, 332.4 keV and 443.6 keV energy. The transitions were all found to be of the E2 type. The cross-section for production of Hf^{180m} in the (n,γ) reaction on Hf^{179} has been determined and found to equal $\sigma = 0.18 \pm 0.07$ barns. See also Abstr. 6446/1957 where preliminary results were given. A.

539.14 : 539.2

4278. PRINCIPLES AND APPLICATIONS OF NUCLEAR MAGNETIC RESONANCE. L.E.Drain.
Brit. J. appl. Phys., Suppl. No. 6 (Physics of non-destructive testing), S27-S33 (1957).

The effect of the small magnetic moments of atomic nuclei can be detected by the principle of magnetic resonance. In a given magnetic field each nucleus with a spin and magnetic moment has associated with it a characteristic resonance frequency. Ordinarily, these resonances lie in the r.f. range and are detected by radio techniques. Nuclear resonance may be used to detect the presence of particular isotopes and for the accurate measurement of magnetic field. The line widths of nuclear resonances in solids are primarily determined by magnetic interactions between nuclei and can provide useful information about internuclear distances. In liquids, molecular motion leads to extremely narrow resonances and fine structures of lines may be resolved. These may be used for molecular structure determination and for the identification of chemical compounds. In metals, nuclear resonance frequencies are shifted by an effect due to the conduction electrons. This shift is related to the electronic structure of the metal. In addition to magnetic moments, many nuclei possess electric quadrupole moments which can interact with electric field gradients in a solid. Whilst in an ideal cubic lattice this interaction is zero, distortion produced by impurities or even mechanical treatment is often sufficient to broaden the magnetic resonance. This effect might be used to study defects in crystal structures. A.

539.14 : 532.5

4279. NUCLEAR RESONANCE SIGNALS IN FLOWING LIQUID. K.Antonowicz.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 5, No. 8, 813-18 (1957).

In a nuclear resonance experiment in which T_1 is long compared with the reciprocal of the modulation frequency, the "wiggles" pattern may be confused by wiggles before resonance is reached. This effect can be removed by flowing the liquid sample through the coil. The theory is fully given and verified experimentally for distilled water. At high flow rates the signal amplitude is inversely proportional to the flow rate. D.H.Whiffen

539.14

4280. NUCLEAR MAGNETIC RESONANCE IN SOME CRYSTALLINE POLYMERS. A.Nishioka, H.Komatsu and Y.Kakiuchi.
J. Phys. Soc. Japan, Vol. 12, No. 3, 283-5 (March, 1957).

Nuclear magnetic resonance absorption was studied for some linear crystalline polymers in the temperature range from liquid-air temperature to the neighbourhood of the melting points of the samples. The second moments of the absorption curve observed for the rigid samples were in accordance with the calculated moments about their assumed crystalline forms. A.

539.14

4281. NUCLEAR MAGNETIC RESONANCE EXPERIMENT ON METAL CADMIUM. Y.Masuda.
J. Phys. Soc. Japan, Vol. 12, No. 5, 523-8 (May, 1957).

The Knight shift, the line width and shape, and the spin-lattice relaxation time of the resonance line in metal cadmium were measured. The resonance line is asymmetric, indicating an anisotropy of the Knight shift. From the analysis of the line shapes, the asymmetry in the p-character of the conduction electron is estimated. The shift perpendicular to the c-axis is 0.42% and parallel to the c-axis 0.46%. The isotropic shift is 0.43%. The skin effect in a metallic-foil is discussed. A.

539.14

4282. NUCLEAR MAGNETIC RESONANCE IN DILUTE Cu–Mn ALLOYS.
W.van der Lugt, N.J.Poulis, G.E.G.Hardeman and W.P.A.Hass.
Physica, Vol. 23, No. 8, 797-8 (Aug., 1957).

The line width Δ of the Cu^{63} resonance was measured between 1° and $100^\circ K$ for compositions of manganese varying from 5×10^{-3} to 10^{-1} atomic per cent. For 0.062% Mn Δ decreased rapidly with increasing temperature from about 70 Oe at $1^\circ K$ to 34 Oe at $4.2^\circ K$. For lower concentrations Δ was much less temperature dependent. The Knight shift was approximately that for pure copper. For one alloy a measurement of T showed a less strong temperature dependence than T^{-1} and at $1^\circ K$ was less than for pure copper.

D.J.Oliver

539.14

4283. DYNAMIC DISTORTIONS OF THE SIGNALS IN NUCLEAR MAGNETIC RESONANCE AND THEIR EVALUATION IN MAGNETIC MEASUREMENTS. S.S.Kurochkin.
Zh. tekh. Fiz., Vol. 27, No. 4, 748-52 (1957). In Russian.

A discussion of the distortion of nuclear magnetic resonance signals, both absorption and dispersion, as a function of the velocity of passage through resonance and other parameters. The results are given in graphical form which enables the resulting errors in magnetic field measurement to be evaluated. D.H.Whiffen

539.14 : 538.222

REPRESENTATION OF EFFECTS OF THE OVERHAUSER TYPE. See Abstr. 4139

RADIOACTIVITY

539.16.08

4284. A METHOD FOR DETERMINING ^{24}Na AND ^{42}K WHEN PRESENT TOGETHER IN LIQUID SAMPLES. M.P.Esnouf.
Brit. J. appl. Phys., Vol. 9, No. 4, 161-2 (April, 1958).

The method is based on the differential absorption of β-particles The relative concentrations of the isotopes are estimated from the difference in the observed counting rates of a sample when it is measured in a type M6 tube and in a modified M6 tube. Details are given for the necessary modification of the M6 tube. A.

539.163

4285. BASIC EXPERIMENT IN RADIOLOGICAL PHYSICS. A.A.Bartlett.
Amer. J. Phys., Vol. 26, No. 5, 281-6 (May, 1958).

The relationship between source strengths in millicuries and gamma-ray exposures in roentgens is discussed in terms of the definitions of these and of other basic quantities of interest in radiological physics. An experiment is discussed which serves to introduce students to these concepts, and in which they can be made aware of some of the hazards of radiation exposure. A.

539.163 : 539.14

4286. STUDIES ON THE LONG-LIVED ACTIVITIES OF EUROPIUM. S.K.Bhattacherjee and S.Raman.
Nuclear Phys., Vol. 4, No. 1, 44-60 (Aug., 1957).

Long-lived activities of europium, Eu^{153} (13 years) and Eu^{154} (16 years), were studied by a coincidence scintillation spectrometer. The measured gamma-ray energies (keV) and their relative intensities are 80 ± 4 (0.52), 124 ± 4 (1.85), 244 ± 7 (1.00), 340 ± 10 (2.16), 410 ± 20 (0.15), 710 ± 25 (0.34), 770 ± 22 (1.27), 870 ± 30 (0.57), 970 ± 20 (1.93), 1090 ± 21 (1.88), 1260 ± 40 (0.5), 1410 ± 25 (1.99). X–gamma and gamma–gamma coincidence experiments were carried out by employing pulse-height selection; beta–gamma coincidences were recorded by using an anthracene crystal spectrometer. Decay schemes for the two isotopes are proposed on the basis of our experimental results. The first two excited states of Sm^{152} reached by the capture decay of Eu^{153} at 121 and 365 keV are identified as rotational levels belonging to the ground-state configuration; higher excited states in Sm^{152} (N = 90) were also reached by capture decay of Eu^{152}. On the other hand the first two excited states of Gd^{152} (N = 88) reached by β-decay of Eu^{153} at 340 and 750 keV are probably vibrational in origin. The ground-state spin of Eu^{153} is assigned as 4. The newly found gamma-ray of energy of 80 keV is identified as the one arising from de-excitation of the first rotational level of Sm^{154}, a state which has also been observed in Coulomb excitation experiments. Decay schemes are discussed in the light of the unified nuclear model. A.

539.163 : 539.17

4287. FORMATION AND PROPERTIES OF SELENIUM 71.
A.H.W.Aten,Jr and A.C.Pieterse.
Physica, Vol. 23, No. 8, 799-800 (Aug., 1957).

Se^{71} was prepared by the reaction $Ge^{70}(\alpha,3n)Se^{71}$; the half-life was 4.5 ± 0.5 min, the nuclide emitting positrons with a maximum energy of 3.4 ± 0.3 MeV. A.O.Stanesby

539.163.1

4288. SCINTILLATION-COUNTER MEASUREMENT OF THE HALF-LIFE OF ThC'. A.Eckardt and K.Heilig.
Exper. Tech. der Phys., Vol. 5, No. 1, 13-16 (1957). In German.

The value obtained was $(3.0 \pm 0.2) \times 10^{-7}$ sec. A.O.Stanesby

539.163.1

4289. P^{32} HALF-LIFE DETERMINATION.
O.U.Anders and W.W.Meinke.
Nucleonics, Vol. 15, No. 12, 68-70 (Dec., 1957).

Pure carrier-free P^{32} prepared by deuteron bombardment of ZnS was counted in a 4π β-counter and the decay followed for 11 half-lives. The new value for the half-life is 14.223 ± 0.015 days. R.D.Smith

539.163.1 : 539.17

LIFETIME OF Th^{232}. See Abstr. 3388

539.164 : 61

4290. ALPHA-RAY ACTIVITIES OF HUMANS AND THEIR ENVIRONMENT. R.C.Turner, J.M.Radley and W.V.Mayneord.
Nature (London), Vol. 181, 518-21 (Feb. 22, 1958).

The material to be measured is prepared by ashing at 600-700°C, grinding and then sealing into a simple tray where it is in intimate contact with a phosphor; scintillation counters are used as detectors. Mean α-activity of people living in various parts of England has been recorded: no correlation appears between this activity and the age of the subject. Activities of various environmental materials, including foodstuffs, are given. A 34 day experiment, in which the α-activity of intake and faecal output of a 4 year old child were measured, is recorded. D.V.Mabbs

539.165

4291. INVESTIGATION OF THE β^+-DECAY IN Ho^{160}.
B.S.Dzhelepov, O.E.Kraft and B.K.Preobrazhenskii.
Dokl. Akad. Nauk SSSR, Vol. 116, No. 4, 581-3 (1957). In Russian.

Various conversion lines from Ho formed in a tantalum target irradiated by 660 MeV protons were measured, and most can be assigned to Ho^{160}. The Curie plots of the positron spectrum were obtained. Their assignments are discussed. G.E.Brown

539.165 : 539.166

4292. β–γ-CORRELATION OF ALLOWED TRANSITIONS IN THE CASE OF NON-CONSERVATION OF PARITY.
Yu.V.Gaponov and V.S.Popov.
Zh. éksper. teor. Fiz., Vol. 33, No. 1(7), 256-9 (1957). In Russian.

The angular correlation of an electron and circularly polarized γ-quantum emitted in a β–γ transition is considered for the case when parity is not conserved. The effect of the Coulomb field of the nucleus is neglected. A.

539.165 : 539.166

4293. MEASUREMENT OF THE CORRELATION BETWEEN β- AND CIRCULARLY POLARIZED γ-RADIATION FROM Co^{60}, Zr^{95} AND Sb^{124}. H.Appel and H.Schopper.
Z. Phys., Vol. 149, No. 1, 103-6 (1957). In German.

The anisotropy coefficient α was measured as: Co^{60} : −0.35 ± 0.05 (E = 1.68 MeV); Zr^{95} : −0.46 ± 0.09 (1.74) and Sb^{124} : −0.13 ± 0.06 (0.69). The results are discussed with reference to the types of interaction involved. A.O.Stanesby

539.165.01

4294. CORRECTION FOR THE GAMMA-RAY SENSITIVITY OF THE BETA-COUNTER IN THE STANDARDIZATION OF COBALT-60 BY THE BETA–GAMMA COINCIDENCE METHOD.
B.Owen and R.A.Lloyd.
Nature (London), Vol. 181, 396-8 (Feb. 8, 1958).

A method is described for correcting for the γ-ray sensitivity of the β-detector by the use of an anthracene scintillation counter with pulse-height selection. This leads to an accuracy in the source-strength determination of ±1.5%. M.A.Grace

539.165.08

4295. DIRECTIONAL DISTRIBUTION OF THE β-RADIATION FROM A SUPPORTED SOURCE. A.Cervellini.
An. Acad. Brasil. Ciênc., Vol. 28, No. 1, 107-14 (1956).
In Portuguese.

An experimental investigation with supports of various thickness and atomic number. L.Pincherle

539.165.2

4296. THE β-INTERACTION COUPLING CONSTANTS AND THE POLARIZATION OF THE EMITTED ELECTRONS. Vinh Mau.
C.R. Acad. Sci. (Paris), Vol. 246, No. 5, 713-16 (Feb. 3, 1958).
In French.

Certain relationships amongst the coupling constants must exist if the electron polarization in β-decay is always v/c. They are briefly discussed. M.A.Grace

539.165.2

4297. β–NEUTRINO CORRELATION FOR ORIENTED NUCLEI. CASE OF POLARIZED NEUTRONS. R.Nataf.
C.R. Acad. Sci. (Paris), Vol. 246, No. 12, 1843-5 (March 24); No. 13, 1987-90 (March 31, 1958). In French.

This is calculated for certain forms of the beta-decay coupling. J.C.Taylor

539.165.2

4298. POLARIZATION EFFECTS FOLLOWING BETA DECAY.
H.Frauenfelder, J.D.Jackson and H.W.Wyld,Jr.
Phys. Rev., Vol. 110, No. 2, 451-5 (April 15, 1958).

With a view to providing alternative methods of determining the dominant invariants in the beta interaction, various polarization effects following the beta decay of unoriented nuclei are discussed. In both K capture and beta emission the recoiling nucleus is polarized along its line of flight. Measurement of this polarization could determine whether the tensor or axial vector interaction is dominant. The hole in the K shell following K capture is also polarized relative to the recoil direction. Measurement of the hole polarization can distinguish between the scalar and vector as well as between the tensor and axial interactions. Methods for detecting the polarizations are discussed. The longitudinal polarization of the recoiling nucleus can in principle be detected directly by atomic beam techniques or indirectly by measuring the correlation between the direction of the recoiling nucleus and the direction and circular polarization of a subsequent radiation (gamma ray, conversion electron, or beta particle). The polarization of the hole in the K shell following K capture can perhaps be determined by a recoil-X-ray circular polarization correlation experiment. A.

539.165.2

4299. CONFIGURATIONAL MIXING IN β-DECAY THEORY.
C.A.Caine.
Proc. Phys. Soc., Vol. 71, Pt 6, 939-56 (June, 1958).

The effect of simple configurational mixing, within the j–j coupling shell model, on the nuclear matrix elements for allowed beta-transitions of odd A nuclei is considered. It is shown that such mixing could be responsible for the unfavoured transitions within the 2d and 1g shells. A.

539.166 : 539.17

4300. TWO CLOSELY SPACED RESONANCES IN THE REACTION $Al^{27}(p,\gamma)Si^{28}$. S.L.Andersen, T.Holtebekk, O.Lönsjö and R.Tangen.
Nuclear Phys., Vol. 4, No. 1, 39-43 (Aug., 1957).

An already known resonance is shown to consist of two separate resonances with E_p = 504.5 ± 0.2 keV, 506.5 ± 0.2 keV. Gamma-transitions from the lower of the two levels proceed mostly to the ground state, while the upper level decays predominantly to the first excited state. A.

539.166

4301. ABSOLUTE INTENSITIES OF RESONANCE NEUTRON CAPTURE GAMMA RAYS FROM Cd, Te, AND Sm.
C.A.Fenstermacher, R.G.Bennett, A.F.Walters, C.K.Bockelman and H.L.Schultz.
Phys. Rev., Vol. 107, No. 6, 1650-4 (Sept. 15, 1957).

The absolute intensities of gamma-rays having energies between 200 and 650 keV, emitted after resonant neutron capture in Cd^{113}, Te^{123}, Sm^{147}, Sm^{149}, and Sm^{152} were measured. The instrumentation involved a combination of time-of-flight technique and multichannel pulse-height analysis using a NaI(Tl) scintillation counter. The even-even compound nuclei studied appear to emit intense low-energy gamma-rays, while the even-odd nucleus Sm^{153} shows no correspondingly intense low-energy transitions. A.

539.166.07

4302. A CIRCULAR POLARIMETER FOR LOW ENERGY γ-RAYS.
M.Bernardini, P.Brovetto, S.Debenedetti and S.Ferroni.
Nuovo Cimento, Vol. 7, No. 3, 416-18 (Feb. 1, 1958).

The instrument is based on back-scattering by magnetized iron. It is pointed out that this design utilizes the maximum difference in the polarization-sensitive part of the scattering cross-section, and is particularly suitable for studying low-energy γ-radiation, M.A.Grace

539.166.08

4303. A DETERMINATION OF THE GAMMA-RAY EMISSION OF RADIUM. F.H.Attix and V.H.Ritz.
J. Res. Nat. Bur. Stand., Vol. 59, No. 5, 293-305 (Nov., 1957).

Measurements of the γ-ray emission of radium (roentgens per milligram-hour at 1 cm) were made by means of a graphite cavity ionization chamber. An auxiliary experimental examination of the stopping-power correction for the non-air-equivalence of the cavity wall is also described. The resulting average value for the γ-ray emission of radium (enclosed in a 0.5 mm platinum capsule) is 8.26 ± 0.05 roentgens per milligram-hour at 1 cm, which is based upon the conclusion that the stopping-power data of Bakker and Segre (Abstr. 4456/1951) are consistent with the results of the auxiliary experiment. A.

539.166.08 : 535.33.07 : 537.531

CRYSTAL REFLECTIVITY IN BENT CRYSTAL SPECTROMETERS. See Abstr. 4052

539.166.2

4304. TRIPLE COINCIDENCE MEASUREMENTS IN THE DECAY OF ^{48}V. B.van Nooijen, J.Konijn and A.H.Wapstra.
Physica, Vol. 24, No. 3, 231-2 (March, 1958).

Possible triple coincidences between the γ-rays following the decay of V^{48} to Ti^{48}, from a cascade proceeding from the 3.24 MeV level via the 2.30 and 0.99 MeV levels to the ground state, were sought with negative result, in disagreement with the work of Casson et al. The absence of a 0.94 MeV transition between the upper two levels had been indicated by the previously measured branching ratio of electron capture to positron emission in the decay of V^{48} to the 2.30 MeV level of Ti^{48}. A possible explanation for the non-appearance of a 0.94 MeV γ-ray, an anomaly according to the shell model, is given in terms of vibrational and rotational bands. A.E.I. Research Laboratory

539.166.2 : 539.14

4305. GAMMA RAYS FROM THE 6.89 MeV LEVEL IN ^{10}B.
R.D.Edge and D.S.Gemmell.
Proc. Phys. Soc., Vol. 71, Pt 6, 926-31 (June, 1958).

Use of a large NaI:Tl crystal has permitted determination of the yield curves of each of the high-energy gamma-rays arising from the $Be^9(p,\gamma)B^{10}$ reaction for proton energies from 220 to 440 keV. The results indicate that all but the ground-state gamma-rays arise from the 6.89 MeV level in B^{10} and this confirms the postulated 20% isotopic spin impurity for this level. The ground-state transitions arise from the broad 7.48 MeV level and there is some evidence for part of this gamma-radiation arising from direct transitions. The 6.89 MeV level can also decay by gamma-ray emission to the 5.11 MeV level. A.

539.166.83 : 539.165.08

4306. THE INFLUENCE OF α RECOIL FROM A NUCLEUS EMITTING INTERNAL-CONVERSION ELECTRONS ON THE FORM OF THE ELECTRON SPECTRUM. R.Foucher and H.Vartapetian.
C.R. Acad. Sci. (Paris), Vol. 246, No. 7, 1031-4 (Feb. 17, 1958). In French.

The change in profile of an electron line due both to nuclei which have recoiled into the source backing and to nuclei which are still moving is calculated for a uniform field β-spectrometer. M.A.Grace

539.166.83

4307. ANOMALOUS INTERNAL CONVERSION RATIOS OF E3 TRANSITIONS IN THE REGION Z = 77-82.
G.Andersson and I.Bergström.
Nuclear Phys., Vol. 3, No. 4, 541-8 (June, 1957).

A systematic disagreement between experimental and theoretical L conversion ratios was observed for E3 transitions in Pb, Tl, Au and Ir. It is shown that multipole mixing cannot explain the discrepancies and that a nuclear size effect seems very improbable. A.

539.166.83

4308. SOME PECULIARITIES OF M1-CONVERSION NUCLEAR TRANSITIONS. D.P.Grechukhin.
Zh. éksper. teor. Fiz., Vol. 33, No. 1(7), 183-9 (1957). In Russian.

M1-conversion nuclear transitions are investigated within the framework of the single-particle model with (LS)-coupling. A.

NUCLEAR REACTIONS

539.17 : 512.942

4309. WAVE-VECTOR TECHNIQUE FOR THE ANALYSIS OF DIRECT INTERACTIONS. G.E.Owen and L.Madansky.
Amer. J. Phys., Vol. 26, No. 4, 260-6 (April, 1958).

A simple technique is developed by means of which one can compute the various components of the differential cross-section for direct interactions. The method for the most part relies upon the identification of the relative motion wave-vectors in a wave-vector diagram. By assigning a Fourier transform to each relative motion wave-vector, the basic functions representing the differential cross-section for stripping reactions, pick-up reactions, etc., are obtained. A.

539.17

4310. REMARKS ON COULOMB EXCITATION. L.Simons.
Comment. phys.-math. (Helsinki), Vol. 21, Paper 2, 13 pp. (1958).

A comparison is made between the values given by different theories for the reduced transition probability B(E2) for Coulomb excitation. This comparison was made between the values for substances from various parts of the periodic system and various energy levels, as well as for various bombarding particles with different energies. That B(E2) is independent of the bombarding particle and of its energy speaks in favour of the newest wave-mechanical theories, as does also the ratio between the B(E2) values for the lowest rotational levels of heavy odd-A nuclei. Comparison between the values of B(E2) obtained from Coulomb excitation and those found from the half-life of de-excitation of an excited level seems to indicate that the sources of error are still of such magnitude as to preclude deduction of any definite results from such comparisons. A.

539.17

NUCLEAR REACTIONS DUE TO COSMIC RAYS. See also under "Cosmic rays". Decimal classification 537.591.8

539.17

4311. ELASTIC SCATTERING OF PROTONS BY A^{40}.
G.D.Freier, K.F.Famularo, D.M.Zipoy and J.Leigh.
Phys. Rev., Vol. 110, No. 2, 446-7 (April 15, 1958).

Measurements of the elastic scattering differential cross-sections were made. For proton energies between 1.75 MeV and 2.75 MeV and at an angle of 155°, the cross-sections are essentially given by the Rutherford equation except for resonances at 1.90 MeV and 2.48 MeV. At these resonance energies, angular distributions for the interaction were measured. A.

539.17

4312. DIRECT INTERACTION IN THE INELASTIC SCATTERING OF HIGH ENERGY PROTONS IN CARBON. C.B.O.Mohr.
Proc. Phys. Soc., Vol. 71, Pt 5, 717-23 (May, 1958).

The angular distribution of elastic and inelastic scattering of

89 MeV protons in carbon is calculated on the distorted-wave approximation, assuming direct interaction in inelastic collisions. Different forms of nuclear potential are tried, and it is found that a satisfactory fit with the experimental curves may be obtained, provided direct interaction is assumed to take place throughout the nuclear volume, and not just at the surface. The Born approximation gives diffraction minima which are much too low, at angles which are appreciably too large; and gives far too little scattering at small angles for electric quadrupole excitation. A.

539.17 : 539.12

4313. THE INELASTIC SCATTERING OF 9.8 MeV PROTONS BY MEDIUM WEIGHT NUCLEI.
G.W.Greenlees, J.Lowe, A.B.Robbins and P.M.Rolph.
Proc. Phys. Soc., Vol. 71, Pt 6, 904-9 (June, 1958).

Recent experiments by Cohen (Abstr. 4714/1957) on the inelastic scattering of protons by nuclei of medium Z have shown some unexpected effects, in particular, a pronounced increase in cross-section at excitements of 2-3 MeV in all elements with Z between 40 and 52. A search for this "anomalous scattering" was made in Sn, In, Cd, Ag, Pd, Mo, Nb, Zn, Cu and Ni, using 9.8 MeV protons. The prominent effect at excitations of 2-3 MeV was not found at 9.8 MeV. In Cu, Zn and Ni an intense group corresponding to excitations of 1 to 1.4 MeV was observed, in agreement with Cohen's results. A.

539.17 : 539.14

SCATTERING AND POLARIZATION OF PROTONS BY NUCLEI. See Abstr. 4257

539.17 : 539.166

RESONANCES IN THE REACTION $Al^{27}(p,\gamma)Si^{28}$. See Abstr. 4300.

539.17

4314. ANGULAR DISTRIBUTIONS OF THE $Si^{28}(d,p)Si^{29}$ REACTION. S.Takemoto, T.Dazai and S.Suganomata.
J. Phys. Soc. Japan, Vol. 12, No. 10, 1057-60 (Oct., 1957).

The angular distributions of five proton groups from the $Si^{28}(d,p)Si^{29}$ reaction were measured in energy range from 0.77 to 1.30 MeV. A complicated compound nucleus effect was observed. A.

539.17

4315. DEUTERON STRIPPING WITH POLARIZED DEUTERONS.
G.R.Satchler.
Nuclear Physics, Vol. 6, No. 4, 543-4 (April [2], 1958).

Information obtained by studying polarization of outgoing protons in a (d,p) stripping reaction with unpolarized incident deuterons may be obtained by studying angular distributions in a (d,p) reaction with polarized incident deuterons. Relations between the proton polarization produced when unpolarized deuterons are used and the differential cross-section when the incident deuterons are polarized were calculated using the distorted-wave Born approximation. L.L.Green

539.17 : 539.14

THE STUDY OF NUCLEAR COLLECTIVE MOTION BY STRIPPING REACTIONS. See Abstr. 4259

539.17

4316. DISCONTINUITIES IN THE ACTIVATION CURVES FOR THE REACTIONS $C^{12}(\gamma,n)C^{11}$ AND $Al^{27}(\gamma,n)Al^{26}$.
R.Basile and M.Gusakow.
C.R. Acad. Sci. (Paris), Vol. 246, No. 4, 588-91 (Jan. 27, 1958).
In French.

The maximum betatron energy, 33.4 MeV, was found by extrapolation from the well-known threshold of the $C^{12}(\gamma,n)C^{11}$ reaction, and the variation of neutron yield from this reaction with γ-ray energy observed. Discontinuities were found at 19.5, 20.15, 20.8 and 21.4 MeV, all ± 0.05 MeV, but one previously reported by Katz et al. at 22.8 MeV was not observed. The threshold of the $Al^{27}(\gamma,n)Al^{26}$ reaction was measured as 12.55 ± 0.10 MeV. Further study of this problem is proposed. Discontinuities in the activation curve were observed at 13.1, 13.4, 13.9, and 14.25 MeV, all ± 0.05 MeV. No discontinuities were found at higher energies close to the maximum of the giant resonance. A.E.I. Research Laboratory

539.17 : 539.14

4317. THE GIANT PHOTONUCLEAR RESONANCE IN THE RARE EARTH REGION. D.H.Wilkinson.
Phil. Mag. (Eighth Ser.), Vol. 3, 567-76 (June, 1958).

The giant resonances of nuclear photodisintegration show a strong correlation between their width and the distance from doubly closed shells. In particular the width becomes very great in the rare-earth region of large permanent nuclear deformations. It is shown, with the aid of the Nilsson level schemes for a deformed harmonic oscillator potential, that the independent-particle model of the giant resonance is capable of providing a quantitative explanation of this broadening. A.

539.17

4318. DISPERSION THEORY OF THE DIRECT PHOTOEFFECT.
G.E.Brown and J.S.Levinger.
Proc. Phys. Soc., Vol. 71, Pt 5, 733-41 (May, 1958).

The process of direct interaction with photons (the emission of fast particles) is formulated in nuclear dispersion theory. The cross-section can be evaluated for energies far from the single-particle resonances; an order-of-magnitude estimate can be made for the region of the resonances. The results are in rough agreement with those from Wilkinson's modified shell model (see Abstr. 1973/1958). The dipole–quadrupole interference is estimated to give an appreciable forward asymmetry for photo-protons. A.

539.17

4319. INELASTIC SCATTERING OF 14 MeV NEUTRONS IN IRON. J.Garg and B.Torki.
C.R. Acad. Sci. (Paris), Vol. 246, No. 5, 750-3 (Feb. 3, 1958).
In French.

The energy spectrum of 14 MeV $T(d,n)He^4$ neutrons was measured by a time-of-flight method after inelastic scattering in iron. Neutron groups of energies 1.3 and 2.5 MeV were observed in addition to groups above 3.0 MeV. These results are not in agreement with those of Graves and Rosen (Abstr. 2721/1953) and others, who obtained a Maxwellian distribution of neutron energies using photographic plate techniques, but are supported by the results of Sherrer et al. (Abstr. 4365/1953) who observed gamma-ray groups of discrete energies. A.E.I. Research Laboratory

539.17

4320. REACTOR NEUTRON-CAPTURE CROSS SECTION OF 18-MINUTE Rb^{88}. J.C.Roy, P.J.Berry and L.P.Roy.
Canad. J. Chem., Vol. 36, No. 5, 731-6 (May, 1958).

The reactor neutron-capture cross-section of 18-minute Rb^{88} was determined by an activation method. The yield of Rb^{88} formed by successive neutron capture in Rb^{87} was determined by counting the beta-rays emitted by its daughter, 51-day Sr^{89}. In these experiments Sr^{89} is also produced by the $Sr^{88}(n,\gamma)Sr^{89}$ reaction from the Sr^{88} contamination in the rubidium target and from Sr^{90} formed by the beta-decay of Rb^{89}. Corrections for the contributions from these sources to the yield of Sr^{89} were measured experimentally. The reactor neutron-capture cross-section of Sr^{88} has been measured to be 5.8 millibarns for the conditions of the experiment. Taking 0.12 ± 0.3 barn for the thermal cross-section of Rb^{87}, the cross-section of Rb^{86} was found to be 1.0 ± 0.3 barn for reactor neutrons. A.

539.17 : 539.12

4321. THE ENERGY AND ANGULAR DISTRIBUTIONS OF THE PROTONS FROM THE REACTION $^{60}Ni(n,p)^{60}Co$ INDUCED BY 13.5 MeV NEUTRONS. P.V.March and W.T.Morton.
Phil. Mag. (Eighth Ser.), Vol. 3, 577-81 (June, 1958).

The energy spectrum and angular distribution of the protons emitted from Ni^{60} on bombardment with 13.5 MeV neutrons were studied using photographic emulsions. About 30% of the protons emitted can be attributed to direct interaction processes. A.

539.17

4322. TOTAL NEUTRON CROSS SECTIONS OF Mg, Al, Fe, Cu, Zn, Mo AND Pb FROM 4 TO 8 MeV. J.L.Weil and K.W.Jones.
Phys. Rev., Vol. 110, No. 2, 466-7 (April 15, 1958).

The cross-sections were measured and the results are compared with previous measurements in the same energy region. A.

539.17

4323. MEASUREMENTS OF (n,α) CROSS SECTIONS AT 14 MeV.
H.G.Blosser, C.D.Goodman and T.H.Handley.
Phys. Rev., Vol. 110, No. 2, 531-3 (April 15, 1958).

Results of activation measurements of the (n,α) cross-section of nine isotopes ranging in mass number from 59 to 133 are reported. The measurements were made at a neutron energy of 14 ± 0.5 MeV using neutrons from the $D(t,n)He^4$ reaction. The cross-sections show a markedly different dependence on mass number from that reported in a previous survey. A.

539.17 : 539.14

4324. FLUCTUATIONS IN SLOW NEUTRON AVERAGE CROSS SECTIONS. P.A.Egelstaff.
Proc. Phys. Soc., Vol. 71, Pt 6, 910-24 (June, 1958).

The wide distribution in the values of the neutron widths and spacings of slow neutron levels leads to fluctuations in the cross-section averaged over several levels. A method of deriving information on the properties of these distributions from observations on the fluctuations is described. Fluctuations in total cross-section measurements are analysed and agreement to order of magnitude is obtained with the predicted width and spacing distributions, but it does not appear that exact agreement is obtained at present. The U^{235} fission cross-section also is analysed by this method, but the results do not agree with the theory of the method. It is probable that these discrepancies are due to the effect of correlations in the distributions. A.

539.17

4325. EFFECTIVE CROSS-SECTION FOR THE REACTION (n,2n) ON Be^9. S.S.Vasil'ev, V.V.Komarov and A.M.Popova.
Zh. éksper. teor. Fiz., Vol. 33, No. 2(8), 527-8 (1957). In Russian.

With neutrons from the reaction Li(d,n), the excitation function for the reaction $Be^9(n,2n)$ is studied by observing the two α-particles in nuclear emulsions. Competing reactions with charged particle emission are also measured. At excitation energies $> \sim 10$ MeV the break-up into $2n + 2\alpha$ seems to predominate over the processes in which Be^8 is first formed. G.E.Brown

539.17 : 539.12

4326. INELASTIC SCATTERING OF HIGH ENERGY NUCLEONS BY COMPLEX NUCLEI. I. SEMI-CLASSICAL FORMALISM. G.P.McCauley and G.E.Brown.
Proc. Phys. Soc., Vol. 71, Pt 6, 893-903 (June, 1958).

A formalism is developed for treating scattering processes in the several hundred MeV range in which the target nucleus is left in its ground state or in a low excited state. These processes are described in terms of collisions between the incident particle and single nucleons of the nucleus, using approximations of a semi-classical nature. The inelastic processes can be regarded as single-particle excitations, the effects of scattering by other nucleons being included in a distorting potential. The target nucleons are assumed stationary during the passage of the incident particle; it is demonstrated that this is a reasonable approximation. A.

539.17

4327. CONSIDERATIONS ON THE PROBABILITY OF NUCLEAR FISSION. R.Vandenbosch and G.T.Seaborg.
Phys. Rev., Vol. 110, No. 2, 507-13 (April 15, 1958).

A semiempirical equation for fission thresholds is extended to include the effects of unpaired nucleons on the rate of spontaneous fission. Excitation functions for the $(\alpha,4n)$ reactions of Ra^{226}, Th^{230}, and U^{236} were measured. These results and reported cross-sections for other $(\alpha,4n)$ reactions in the heaviest elements are analysed in terms of fission and neutron-emission competetion to obtain mean values of Γ_n/Γ_F. These mean values of Γ_n/Γ_F are correlated with neutron binding energies and fission thresholds. A.

539.17

4328. SOME PROBLEMS OF APPLICATION AND PRACTICAL DESIGN OF NEUTRON AMPLIFIERS. I.
A.Neszmélyi and K.Simonyi.
Periodica polytech., Elect. Engng, Vol. 1, No. 1, 73-88 (1957).

A neutron amplifier is defined as a subcritical system, which contains fissionable material and moderator and is built for the purpose of continuously increasing a neutron flux, produced externally. The amplification factor is derived for different quantities of variously enriched fissionable material and different moderators in several geometrical layouts. The stability of various systems is briefly considered. T.O.Jeffries

539.17 : 539.18 : 530.145

NUCLEAR FISSION CATALYSED BY μ-MESONS. See Abstr. 3692

539.17

4329. CRITICAL MASS MEASUREMENTS FOR THE MERLIN RESEARCH REACTOR.
D.R.Chick, K.Firth, M.Kerridge and A.J.Salmon.
Nature (London), Vol. 181, 1171-3 (April 26, 1958).

The type of core to be used in a light-water-moderated reactor using highly enriched uranium fuel is described, and calculations of the critical mass are discussed. A sub-critical facility has been built to check the critical mass, and this facility and its safety features are described. The critical masses for different core configurations are determined by measuring the neutron fluxes at three positions outside the core as a function of the mass of U^{235} loaded using a neutron source of strength 10^6 n/sec fixed below the core. Reciprocals of the counting rate plotted against mass of U^{235} give straight-line graphs from which the critical mass can be determined by extrapolating to zero reciprocal counting rate. The minimum critical mass for a compact core was found to be 2656.7 ± 1.5 g of U^{235}, which is in satisfactory agreement with calculated values. A table of eleven critical mass determinations for different core conditions is given. A.E.I. Research Laboratory

539.17

4330. ENERGY EVOLVED BY A THERMONUCLEAR PLASMA OF DEUTERIUM.
E.Lacombe, D.Magnac-Valette and P.Cüer.
C.R. Acad. Sci. (Paris), Vol. 246, No. 5, 744-6 (Feb. 3, 1958).
In French.

A numerical calculation of the thermonuclear power as a function of time from the start of a hypothetical pulse when all the gas is deuterium. Includes the contributions from the secondary reactions T(d,n), He^3(d,p) and T(t,2n), of which the first two are important. Assumes that all reacting particles are always in thermal equilibrium at the same, constant, temperature. Quotes a preliminary measurement of the D(d,p) cross-section as 6×10^{-8} barns at 10 keV. R.S.Pease

539.17

4331. DESIGN AND USES OF A LIGHT-WATER-MODERATED SUBCRITICAL ASSEMBLY. E.W.McDaniel and T.A.Elliott.
Amer. J. Phys., Vol. 26, No. 3, 168-74 (March, 1958).

The utility of subcritical assemblies in the development of nuclear reactors and as educational tools is discussed. A detailed description of the light-water-moderated, natural uranium assembly at the Georgia Institute of Technology is presented. A.

539.17

4332. SCIENTIFIC PROBLEMS IN THE DEVELOPMENT OF NUCLEAR POWER. J.Cockcroft.
Brit. J. appl. Phys., Suppl. No. 5, (The physics of nuclear reactors), S1-S8 (1956).

539.17

4333. THE PHYSICS OF ADVANCED REACTORS. J.R.Dietrich.
Brit. J. appl. Phys., Suppl. 5 (The physics of nuclear reactors), S9-S23, S24-S26 (1956).

An attempt is made to characterize the various promising types of solid fuel power reactor in terms of the neutron-physics characteristics of their moderators, coolants and fuel cycles. The neutron-physics design objectives which have the greatest effect on power cost are: (i) use of a fertile isotope (uranium 238 or thorium 232) as a major source of energy; (ii) internal conversion ratio high enough to allow long fuel element life; (iii) safety characteristics favourable enough to avoid remote location and high containment cost. These objectives are not restrictive enough to define the "best" reactor type, but they are the major factors in determining the composition and geometric arrangement of specific reactor designs once the type has been chosen. The thermal reactors which are at present being designed or constructed utilize uranium 235 as the initial fissile isotope, and there is a strong incentive to utilize ratios of fissile to fertile material which depart as little as possible from the "natural" value. With this additional design restriction, the lattice characteristics appropriate to the various moderator-coolant combinations are still more sharply defined. Examples are drawn from the current group of reactor designs to illustrate these characteristics. The possible consequences of a greater latitude in the choice of fissile-fertile ratio are discussed, and the relative characteristics of the possible fuel cycles are considered. The characteristics of fast reactors fit into a quite different pattern. The possible conversion ratio is high on either fuel cycle, and the reactivity changes associated with fuel burn-up are relatively low simply because of the very large fissile-material content of the reactor. The requirement that the average neutron energy be kept high is a rather restrictive one. It appears now that the range of variation in fast reactor design will be less than that in the thermal reactor field. The characteristics of typical fast reactors are presented, their special problems are discussed, and some recent experimental results are quoted. A.

539.17

4334. EXPERIMENTAL REACTOR PHYSICS. P.W.Mummery.
Brit. J. appl. Phys., Suppl. No. 5 (The physics of nuclear reactors), S27-S32, S41 (1956).

The successful design, construction and operation of nuclear reactors requires detailed information concerning the interaction of various nuclear radiations with matter. In principle this can be obtained from a knowledge of fundamental atomic and nuclear properties combined with mathematical analysis. In practice a considerable number of integral measurements are required. These experiments measure combinations of various fundamental atomic and nuclear properties and the predictions of the mathematical analysis. The detailed information required is outlined and various integral measurements are discussed together with their correlation with fundamental data and with various mathematical models. Consideration is given to the use of sub-critical, and low-power and high-power critical reactor assemblies in this field. A.

539.17

4335. THE ZERO-ENERGY FAST BREEDER REACTOR, ZEPHYR. L.R.Shepherd.
Brit. J. appl. Phys., Suppl. No. 5 (The physics of nuclear reactors), S32-S41, S41 (1956).

ZEPHYR is a small low-power fast reactor with a plutonium core surrounded by an envelope of natural uranium. No cooling is required since the maximum operating power is about 2 W. This reactor was used to make a detailed study of the neutron physics of fast reactors. Of the many aspects investigated, particular attention was given to a determination of the breeding characteristics of the system and the measurement of the nuclear parameters required for a theoretical interpretation of fast reactors. A.

539.17 : 539.21

4336. THE EFFECTS OF IRRADIATION ON THE PHYSICAL PROPERTIES OF SOLIDS. A.H.Cottrell.
Brit. J. appl. Phys., Suppl. No. 5, (The physics of nuclear reactors), S43-S49, S49-S53 (1956).

Ionizing radiations dissipate most of their energy in solids by exciting electrons. Severe radiation damage is produced in organic substances by this process, but in metals the free electron structure is immune to ionization damage. Atoms are displaced by collisions with fast particles and the point defects so created alter the electrical and thermal properties of solids. These point defects interact strongly with dislocations so that the mechanical properties of metals are sensitive to heavy-particle bombardment. In semiconductors the displaced atoms can trap electrons and holes, thereby producing large changes in electrical properties. Prolonged bombardments produce drastic effects; some minerals become non-crystalline, uranium crystals change shape, some metals become brittle, and rare gas atoms created by transmutations may produce swelling and disintegration at high temperatures. A.

539.17

4337. SHIELDING FOR REACTORS. G.C.Laurence.
Brit. J. appl. Phys., Suppl. No. 5 (The physics of nuclear reactors), S54-S59, S82-S87 (1956).

A brief discussion is given of the design of shielding for nuclear reactors. It includes consideration of design requirements, choice of materials and dimensions, nuclear reactions that affect the penetration, heating of the shielding and production of radioactivity in the coolant. Because the basic data available are insufficient for high accuracy in design calculation, the use of very complex theory and very laborious calculation has little advantage. Very approximate methods are used, and allowances made for possible error in calculating the thickness of shielding required. The problem is simplified by neglecting radiation processes that have relatively little effect on the overall penetration, but the importance of these effects depends on the design of the shielding. A.

539.17

4338. THE CONTROL OF REACTORS. A.J.Salmon.
Brit. J. appl. Phys., Suppl. No. 5 (The physics of nuclear reactors), S59-S70, S82-S87 (1956).

The concepts of reactivity, neutron lifetime and delayed neutrons are described and their relationships with the rate of change of neutron density and reactor power are discussed. The amounts of reactivity to be controlled in a reactor may be large and varying with time. The various components of this reactivity are noted and discussed. The physical methods of control are surveyed and the safety of reactors is briefly considered. A.

539.17

4339. THE INSTRUMENTATION OF REACTORS. W.Macrae.
Brit. J. appl. Phys., Suppl. No. 5 (The physics of nuclear reactors), S71-S81, S82-S87 (1956).

A survey is presented of the instruments needed for the normal operation of reactors. All reactors produce power: the instruments used for its measurement and control and its effect on the temperature of the reactors components are described. These include instruments operated from detectors sensitive to neutron flux and those concerned with physical measurements such as temperature and flow of coolant. The principles of operation of the various instruments are described and their relative importance under various operating conditions indicated. In power reactors instruments are also necessary for the determination of the change of the neutron flux pattern with time and for the detection of faults in protective fuel containers. The basic principles of such instruments are described. An assessment of the essential instruments for a large power producing reactor is made. A.

539.17

4340. THE ROLE OF CHEMISTRY IN A NUCLEAR ENERGY PROJECT. R.Spence.
Brit. J. appl. Phys., Suppl. No. 5 (The physics of nuclear reactors), S88-S91 (1956).

The following topics are considered: raw materials; production of fuel elements and other special reactor materials; reactor chemistry; chemical processing of irradiated materials; disposal and utilization of radioactive waste materials. A.

539.17

4341. THE ROLE OF METALLURGY IN A NUCLEAR ENERGY PROJECT. L.Rotherham.
Brit. J. appl. Phys., Suppl. No. 5 (The physics of nuclear reactors), S91-S95 (1956).

539.17

4342. THE CANADIAN RESEARCH REACTORS AND THEIR USES. W.B.Lewis.
Brit. J. appl. Phys., Suppl. No. 5 (The physics of nuclear reactors), S96-S100, S103-S106 (1956).

The heart of the programme at Chalk River is the high-flux, heavy-water-moderated NRX reactor. The primary aims justifying this and the NRU reactor are to explore the possibilities of deriving low-cost electricity from nuclear energy, and to foster basic research in nuclear physics, nuclear chemistry, radiation physics, chemistry and biology. Emphasis is given to the production of plutonium and uranium-233, as well as to certain radioisotopes, tritium and cobalt among others. Results obtained in the NRX reactor indicate that once the large development costs have been worked off nuclear power costs will be definitely lower than present-day alternatives. Very full programmes lie ahead, not only for the NRX reactor, but also for ZEEP, which is mostly used for measurements on fuel arrangements, and a proposed PTR ("Swimming-Pool" Test Reactor) which will take over the function of ZEEP for measuring reactivity effects of materials, particularly after irradiation. The most powerful and versatile research reactor is, however, the NRU, a heavy-water-cooled and moderated, high-flux reactor. A.

539.17

4343. THE UNITED KINGDOM RESEARCH REACTORS AND THEIR USES. F.W.Fenning.
Brit. J. appl. Phys., Suppl. No. 5 (The physics of nuclear reactors), S100-S103, S103-S106 (1956).

539.17

4344. APPLYING THERMODYNAMICS TO LIQUID-METAL-FUEL REACTOR TECHNOLOGY. J.J.Egan and R.H.Wiswall, Jr.
Nucleonics, Vol. 15, No. 7, 104-6 (July, 1957).

Activity coefficients at infinite dilution of Ce, Mg, U, Li and Na in Bi were measured in a galvanic cell at 500°C as 3×10^{-14}, 2×10^{-3}, 1×10^{-5}, 1×10^{-5} and 8.5×10^{-5}, respectively. The use of these data in reactor calculations is illustrated by examples.

R.D.Smith

539.17

4345. FRENCH REACTOR INSTRUMENTATION. J.Weill.
Nucleonics, Vol. 15, No. 8, 45-9 (Aug., 1957).

Automatic control of the power level of a reactor is achieved by servo-mechanical operation of the control rods using a power-error signal modified by a signal proportional to the reactivity. The power level is measured using bismuth-shielded, gamma-compensated ion chambers, which are operative over nine decades

of power. The reactivity signal is obtained either by differentiating the output of a logarithmic amplifier, or by operating on the output of a linear amplifier with a simple analogue computer.

R.D.Smith

539.17

4346. SPECIAL POWER EXCURSION REACTOR TEST III.
T.R.Wilson.
Nucleonics, Vol. 15, No. 8, 68-71 (Aug., 1957).

SPERT-III is a heterogeneous thermal reactor with pressurized water coolant. It is capable of operation at 60 MW for 30 min at 2500 lb/in^2 and 650° F, and is designed for the experimental investigation of the safety of similar types of reactor. The core is accessible and can be varied in shape and size. R.D.Smith

539.17

4347. TEFLON CRITICAL-EXPERIMENT FUEL ELEMENTS.
J.L.Swanson and F.H.Welch.
Nucleonics, Vol. 15, No. 8, 90, 92-3 (Aug., 1957).

Flexible sheets 4.5 mil thick, each containing 3.1 g of U_3O_8, were hot-pressed from a mixture of the oxide and Teflon. The sheets were embrittled after about a year by the radioactivity of the uranium, but were still usable after 18 months. The oxide is recoverable by heating. R.D.Smith

539.17

4348. GLASS FIBERS — A NEW FORM FOR REACTOR FUELS.
P.Harteck and S.Dondes.
Nucleonics, Vol. 15, No. 8, 94-8 (Aug., 1957).

The fibres (1 and 25 μ thick) were irradiated in neutron fluxes of 3×10^{12} neutrons cm^{-2} sec^{-1}. More than 60% of the kinetic energy of the fission products escaped from the smaller fibres. It is suggested that fibres could be used as fuel elements in power reactors, or in reactors for the utilization of fission-product recoil energy for radiochemical processes. R.D.Smith

539.17

4349. EVALUATION OF A HOMOGENEOUS REACTOR.
Nucleonics, Vol. 15, No. 10, 64-71 (Oct., 1957).

A detailed study shows this reactor type is feasible for the generation of electric power, but at a cost three times that of conventional plants. The reactor studied generates 560 MW of heat from a fuel solution of $U^{233}O_2SO_4$ in D_2O, which cools both the core and the ThO_2-pellet blanket. Maintainance costs are expected to be very high. R.D.Smith

539.17

4350. PLUTONIUM RECYCLE TEST REACTOR. R.M.Fryar.
Nucleonics, Vol. 16, No. 1, 62-3 (Jan., 1958).

A 66 MW (heat), heavy-water-cooled and -moderated reactor is described, which was designed to provide data on the nuclear physics, fuel element design and performance, and on the technology of thermal heterogeneous power reactors using a plutonium fuel cycle. The main reactivity control will be by variation of the mod moderator level. The reactor will be built in a 80 ft diameter containment vessel, and is due to start up in 1960. R.D.Smith

539.17

4351. THE ENGINEERING TEST REACTOR — A STATUS REPORT. R.L.Doan.
Nucleonics, Vol. 16, No. 1, 102-5 (Jan., 1958).

E.T.R. went critical on 19 September 1957, and several problems were revealed during the initial tests and operation. The flat fuel elements were found to buckle under the hydraulic stresses at full flow-rates, and with the present design the flow-rates will be limited to 18 ft/s and the maximum power to 90 MW. Alternative fuel plate designs are being considered. The fuel section of the control rods was found to be inadequately cooled and modifications were also necessary to the actuator rods and hold-on magnets. Reactivity measurements were made in E.T.R.C., which is a full-scale, zero-power critical assembly built adjacent to the reactor. The average worth of the grey shim rods is 1% $\Delta k/k$, as predicted, but the black shim rods control only 1.5% $\Delta k/k$ compared with 3.6% predicted. The total excess reactivity with 49 fuel elements was 1.5% (11% predicted). R.D.Smith

539.17

4352. AIRCRAFT SHIELD TEST REACTOR.
J.C.Nance and L.W.Perry.
Nucleonics, Vol. 16, No. 1, 58-61 (Jan., 1958).

A 1 MW (heat), light-water-moderated and -cooled reactor with a core of U—Al plate fuel elements. The installation and operation in a B36 aircraft are described. R.D.Smith

539.17

4353. V.B.W.R. — VALLECITOS BOILING WATER REACTOR.
Nucleonics, Vol. 16, No. 2, chart facing 76 (Feb., 1958).

A 30 MW (heat), light-water reactor (Nucleonics Reactor File No. 4). The core contains 23 kg U^{235} as UO_2 in stainless-steel, plate-type fuel elements. Control is by steel-clad B_4C absorbing rods. The reactor went critical in August 1957, and now generates 6 MW of electrical power. It has proved very stable in operation.

R.D.Smith

539.17

4354. PWR — PRESSURIZED WATER REACTOR.
Nucleonics, Vol. 16, No. 4, 53-72, and chart facing 56 (April, 1958).

The P.W.R. is a 230 MW (heat), 60 MW (electrical), light-water-moderated reactor. The core contains 75 kg of 93% enriched U^{235} and 14 tons of natural uranium. The enriched uranium-alloy fuel-plates are clad in Zircalloy—2, and the natural uranium is in the form of sintered UO_2 pellets in a Zircalloy tube. The core is contained in a stainless-steel-clad, carbon-steel pressure-vessel, 32 ft high and 9 ft in diameter, and operates at 2000 lbs/in^2. Details are given of the neutron physics of the core and the engineering design of the plant. P.W.R. first went critical and first delivered 60 MW of electrical power in December 1957. The cost of power from this reactor is high ($\cong$ 65 mils/kWh), but its purpose is to provide design data for future reactors. R.D.Smith

539.17 : 530.162

4355. ON THE THEORY OF STOCHASTIC PROCESSES IN NUCLEAR REACTORS. L.Pál.
Nuovo Cimento Suppl., Vol. 7, No. 1, 25-42 (1958).

A general theoretical treatment of the stochastic processes taking place in reactors is developed. The similarity of the theory to that of cosmic ray cascades is utilized to determine the first and second moments of the distribution function. T.O.Jeffries

539.17

4356. CALCULATION OF SIZES, EFFECTS AND NEUTRON FLUXES IN CYLINDRICAL GRAPHITE REACTORS, ON ALL SIDES SURROUNDED BY A FINITE REFLECTOR. L.Simons.
Tekn. Fören. Finland Förhandl., Vol. 78, No. 2, 20-32 (Jan. 25, 1958). In Finnish.

The calculation of critical size was made for two values of the multiplication constant and for numerous values of the height. For the neutron flux in the reactor core the following approximation is used: Φ = constant . $J_0(\alpha r) \cos \beta z$. The minimum volume of the reactor core and the flux function in all reactor and reflector regions were examined. A.

539.17

4357. ABOUT THE STAR-LIKE FUSION REACTOR.
K.Simonyi and M.Uzsoky.
Periodica polytech., Elect. Engng, Vol. 1, No. 3, 243-57 (1957).

The radius of a self-sustaining D—T reactor is calculated to be about 1 km for a pressure of 1000 atm, assuming containment is solely by material walls withstanding conceivable pressures and temperatures. Some of the practical difficulties could be surmounted by launching the reactor into a satellite orbit. R.S.Pease

539.17

4358. RAPID METHOD FOR DATING NUCLEAR EXPLOSIONS.
S.Akpinar.
Nucleonics, Vol. 15, No. 7, 88-9 (July, 1957).

The ratio of counting rates of all-out products, using 10 and 30 mg/cm^2 absorbers, was used to determine the age of the samples. The method is quicker than measuring the decay curves of the samples, and is accurate if strong samples are available.

R.D.Smith

ATOMS

539.18

4359. EXPERIMENTAL DETERMINATION OF THE ELECTRON AFFINITY OF FLUORINE. T.L.Bailey.
J. chem. Phys., Vol. 28, No. 5, 792-8 (May, 1958).

Two methods are described for mass spectrometric determination of the electron affinities E(X) of electronegative atoms X. Both methods were used to determine the electron affinity of fluorine, E(F), the best measured value being E(F) = 82.1 ± 2.1 kcal/mole. In the first method the ratio of numbers of X^- negative ions to M^+ positive ions emitted from a hot tungsten filament in MX salt vapour is measured. From this the equilibrium constant for the attachment

$X + e^- = X^-$, and hence E(X), may be calculated. In the second method, the difference in electron affinities, E(Y) – E(X), is calculated from a measurement of the ratio of numbers of Y^- to X^- ions emitted from a hot filament surrounded by X_mY_n gas. Measurements were also made for the other halogens; these gave E(Cl) = 96.6 ± 2.0 kcal/mole, E(Br) = 80.9 ± 1.5 kcal/mole, and E(I) = 73.2 ± 1.7 kcal/mole. A.

539.18

4360. HARTREE–FOCK FUNCTIONS AND SPECTRAL ISOTOPE SHIFT FOR EXCITED STATES OF CARBON AND OXYGEN.
J.P.Nicklas and C.E.Treanor.
Phys. Rev., Vol. 110, No. 2, 370-4 (April 15, 1958).

Hartree–Fock type atomic wave-functions have been calculated for the 3s ^{5}S and 3p ^{5}P terms of oxygen and for the 2p3s ^{1}P term of carbon. The calculations were carried out on an I.B.M. card programmed calculator. A simple rapidly-coverging method for determining the eigenvalues was developed. Spectral isotope shifts were computed for the $3s\ ^5S–3p\ ^5P$ and other transitions of oxygen and for the $2p^2\ ^1S–2p3s\ ^1P$ transition of carbon. The results are compared with values previously reported by the authors, computed with wave-functions without exchange. A comparison is made between these calculated values and the experimental determinations. For oxygen, the values of the specific shifts computed with exchange agree with measured values to within experimental error and are much better than the results obtained without exchange. For carbon, the isotope shift value using exchange shows no improvement on the value without exchange, both calculations disagreeing slightly with experimental results. A possible reason for the difference in behaviour between the results for oxygen and carbon is postulated, based on the relative magnitudes of factors making up the formula for isotope shift. A.

539.18

4361. EXCITED-STATE WAVE FUNCTIONS, EXCITATION ENERGIES, AND OSCILLATOR STRENGTHS FOR ARGON ($3p^5 4s$).
R.S.Knox.
Phys. Rev., Vol. 110, No. 2, 375-81 (April 15, 1958).

Solutions of the Hartree–Fock equations for the P^3 and P^1 terms of argon ($3p^5 4s$) are obtained. Wave-functions are tabulated and results of computations of excitation energies and oscillator strengths are presented. The former fall within 4% of experimental values. Predicted oscillator strengths for absorption at 1049 A and 1067 A are 0.20 and 0.05, respectively, with an estimated error of 10 to 20%. A.

539.18

4362. WAVE FUNCTIONS FOR THE HYDROGEN ATOM IN SPHEROIDAL COORDINATES. I. THE DERIVATION AND PROPERTIES OF THE FUNCTIONS. C.A.Coulson and P.D.Robinson.
Proc. Phys. Soc., Vol. 71, Pt 5, 815-27 (May, 1958).

The Schrödinger equation is set up for the hydrogen atom using spheroidal coordinates with the nucleus at one focus, and it is solved as completely as possible. An expression is obtained for the wave-function in a general excited state, and orthogonality properties are proved. Relations are investigated between spheroidal, spherical polar and parabolic wave-functions. A.

539.18 : 530.145

4363. WAVE FUNCTIONS FOR THE HYDROGEN ATOM IN SPHEROIDAL COORDINATES. II. INTERACTION WITH A POINT CHARGE AND WITH A DIPOLE. P.D.Robinson.
Proc. Phys. Soc., Vol. 71, Pt 5, 828-42 (May, 1958).

The interactions of a point charge and of a point dipole with a hydrogen atom are investigated. Interaction energies, dipole and quadrupole moments are calculated using exact perturbation theory. Spheroidal coordinates are necessary to solve the differential equations which arise, and wave-functions for the atom in these coordinates are seen to be the correct zero-order ones to use. The exact form of the perturbing potential is employed, giving results with both polynomial and exponentially decreasing terms. These are compared with the simpler but less accurate results obtained when the expanded form of the perturbation is used. A.

539.18

4364. THE LIMITING BEHAVIOUR OF ATOMIC WAVE FUNCTIONS FOR LARGE ATOMIC NUMBER. II. C.Froese.
Proc. Roy. Soc. A, Vol. 244, 390-7 (March 25, 1958).

For previous part see Abstr. 6477 (1957). If $P_N(nl;r)$ is the (nl) wave-function for an electron in an atom of atomic number N, and $P_H(nl;r)$ is the corresponding hydrogen wave-function, then for a given configuration and large N

$$N^{-1/3}P_N(nl;r) = P_H(nl;Nr) + (1/N)\,Q(nl;Nr) + (1/N^2)\,R(nl;Nr) + O(1/N^3).$$

The equations for the functions R(nl;Nr) were set up and solved for the configurations whose outer groups are $(2p)^6$, $(3s)^2$, $(3p)^6$, $(3d)^5$ and $(3d)^{10}$. From the solutions the limiting slope of a screening number $\sigma(nl)$ as a function of the mean radius r has been computed for r = 0. It was found that the variation with respect to r of $\sigma(3s)$ and $\sigma(3p)$ of the $(3d)^{10}$ configuration was far from linear. Plots of $\sigma(nl)$ as functions of r were drawn more accurately than was possible previously. As a result the estimation of wave-functions using a process of interpolation will be more accurate as well. A.

539.18 : 539.19

4365. ELECTRON CONFIGURATIONS IN GROUND STATE SYSTEMS. P.G.Dickens and J.W.Linnett.
Trans Faraday Soc., Vol. 53, Pt 8, 1037-41 (Aug., 1957).

The general principles of calculating the probabilities of particular electron configurations for systems in their ground states, when inter-electronic repulsion is ignored, were examined. As examples, the eight outer electrons of the neon atom and the six bonding electrons of the nitrogen molecule were considered. The reasons why Linnett and Poë, on the one hand, and Lennard-Jones and Brickstock and Pople on the other, reached different conclusions were studied. A.

539.18

4366. C^{12} AS THE BASIS OF A COMMON SCALE FOR ISOTOPIC MASSES AND ATOMIC WEIGHTS.
T.P.Kohman, J.Mattauch and A.H.Wapstra.
Naturwissenschaften, Vol. 45, No. 8, 174-5 (1958). In German.

The advantages of the choice of C^{12} as reference isotope of mass exactly equal to 12 mass units are summarized. W.Good

539.18

4367. THE PRODUCTION AND USES OF ELECTROMAGNETICALLY ENRICHED ISOTOPES. A.Bisi.
Energia nucleare, Vol. 5, No. 2, 85-9 (Feb., 1958). In Italian.

An electromagnetic separator is described and tables of the availability, cost, and uses of enriched stable nuclides are given. H.C.Cole

539.18 : 539.17 : 530.145

NOBELIUM AND NEW ISOTOPES OF FERMIUM AND EINSTEINIUM. See Abstr. 3692

539.18

4368. THE ELASTIC SCATTERING OF SLOW ELECTRONS BY HYDROGEN ATOMS.
B.H.Bransden, A.Dalgarno, T.L.John and M.J.Seaton.
Proc. Phys. Soc., Vol. 71, Pt 6, 877-92 (June, 1958).

Variational methods are used to calculate phases for the s- and p-wave scattering of electrons by hydrogen atoms. Full allowance is made for electron exchange and the influence of polarization is investigated. The derived elastic cross-sections are compared with experimental results. A.

539.18

4369. ELECTRON CAPTURE IN SLOW COLLISIONS.
D.R.Bates and R.McCarroll.
Proc. Roy. Soc. A, Vol. 245, No. 1241, 175-83 (1958).

It is pointed out that certain faults in the customary formulation describing electron capture in slow collisions arise from the defective character of the electronic eigenfunctions used in the standard expansion. These eigenfunctions satisfy the appropriate equations for all internuclear separations if the velocity of relative motion is zero; but they do not as they should, satisfy it for all velocities of relative motion when the internuclear separation is infinite. When suitably modified eigenfunctions are adopted the faults mentioned disappear. The equivalence of the impact parameter and wave treatments is verified both for non-resonance and for resonance capture. A.

539.18

4370. CROSS-SECTIONS FOR ELASTIC COLLISION OF HYDROGEN ATOMS WITH ONE ANOTHER. V.S.Kudryavtsev.
Zh. éksper. teor. Fiz., Vol. 33, No. 1(7), 243-50 (1957). In Russian.

The cross-sections for elastic scattering of unexcited hydrogen atoms by one another are computed by the method of perturbed stationary states. These cross-sections are encountered in the kinetic theory of gases. A graph is given for the dependence of the cross-sections on the energy of relative motion in the energy range from 0.05 eV to 3 keV. A.

539.18

4371. ENERGY OF INTERACTION BETWEEN TWO EXCITED HYDROGEN ATOMS IN EITHER 2s or 2p STATES.
B.Linder and J.O.Hirschfelder.
J. chem. Phys., Vol. 28, No. 2, 197-207 (Feb., 1958).

A complete set of potential energy curves arising from the interaction between two excited hydrogen atoms in either 2s or 2p states is given for intermediate and large internuclear separations. These include first- and second-order perturbation energies. The first-order perturbation energies are obtained by using exact integrals and properly symmetrized wave-functions with an effective nuclear charge of unity. The possibility of occurrence of ionic states, which become important at small internuclear separations, is ignored. The first-order energies are essentially Coulombic in the long-range region and can be described in terms of simple electrostatic dipole–dipole, dipole–quadrupole and quadrupole–quadrupole interactions. Approximate values of the second-order perturbation energies are obtained by using nonsymmetrized wave-functions and omitting in the expansion of the perturbation potential all terms beyond the leading one. For most states, the second-order perturbation energies are small compared to the first-order energies throughout the long-range region. A.

539.18

4372. INTERACTION ENERGY AND SCATTERING CROSS SECTIONS OF H^- IONS IN HELIUM. E.A.Mason and J.T.Vanderslice.
J. chem. Phys., Vol. 28, No. 2, 253-7 (Feb., 1958).

An approximate quantum mechanical calculation is made of the energy of interaction of H^- and He. The results are not of high accuracy, but serve to indicate the general nature of the interaction. This knowledge makes it possible to calculate more accurate values of the interaction from measured elastic scattering cross-sections. The resultant interaction is combined with the previously known interaction of H and He to give an approximation to the inelastic (electron detachment) cross-section, which is shown to be in reasonable agreement with experiment. The calculations emphasize the importance of the repulsion forces rather than the attraction forces. The accuracy of a correction for the finite width of the ion beam is also examined in some detail. A.

MOLECULES

539.19

4373. A METHOD OF EVALUATING THE DISSOCIATION CONSTANT IN THE EXCITED STATE OF A MOLECULE. R.Itoh.
J. Phys. Soc. Japan, Vol. 12, No. 7, 829 (July, 1957).

To compare dissociation constants in ground and excited states of a molecule which liberates a proton in both states, the equilibrium $GH + E^- = G^- + EH$ is considered. Ignoring entropy differences, the standard free energy change in the reaction is expressed by the difference in resonance energy of the π-electrons. Application to β-naphthol leads to a difference $pK_g - pK_e = 5.62$, fairly near the experimental one of 6.67 obtained from absorption spectra in acid and alkali solution. J.Jacobs

539.19

4374. ON THE CLASSICAL MECHANICS OF THE INTERNAL ROTATION OF MOLECULES. C.C.Lin.
Amer. J. Phys., Vol. 26, No. 5, 319-23 (May, 1958).

The classical solution is given for a symmetric rotor which, in addition to the three degrees of freedom corresponding to the over-all rotation, has also a degree of freedom for internal rotation about the axis of symmetry. The case of free internal rotation and hindered torsion with a potential barrier of the form $\frac{1}{2}V_0(1-\cos n\alpha)$ are discussed. It is found that the classical dipole radiation frequency of a symmetric-top molecule is not affected by the internal rotation. A.

539.19

4375. VIBRATION–ROTATION BANDS OF AMMONIA. II. THE MOLECULAR DIMENSIONS AND HARMONIC FREQUENCIES OF AMMONIA AND DEUTERATED AMMONIA.
W.S.Benedict and E.K.Plyler.
Canad. J. Phys., Vol. 35, No. 10, 1235-41 (Oct., 1957).

A summary is given of molecular constants for NH_3 and ND_3 as derived from high-resolution infrared spectra of a number of fundamental, overtone, and combination bands. Preliminary estimates are given for the equilibrium moments of inertia, the molecular dimensions, and the force constants of the harmonic potential function. The average molecular dimensions in the equilibrium configuration are $r_e = 1.011_6 \times 10^{-8}$ cm, $h_e = 0.381_0 \times 10^{-8}$ cm. A.

539.19

4376. SECOND-ORDER SUM RULE FOR THE VIBRATIONS OF ISOTOPIC MOLECULES AND THE SECOND RULE OF THE MEAN.
J.Bigeleisen.
J. chem. Phys., Vol. 28, No. 4, 694-9 (April, 1958).

A second-order sum rule for the vibrational frequencies of isotopic molecules is derived. The rule relates the second power of the λ's, $\Sigma\lambda_i^2$ and $\Sigma_{i\neq j}\lambda_i\lambda_j$, for isotopic molecules of the type $X'Y_{Z-r}Y_{r'}$ and $XY_{r'}$ with the second power of the λ's for the symmetrical molecules $X'Y_{Z'}$, $XY_{Z'}$, $X'Y_Z$, and XY_Z. Special consideration is given to the case where X' and X are in fact Y' and Y in positions structurally equivalent to the z Y atoms in XY_Z. In the latter case, if z is greater than 2, the rule may involve isotopic isomers. Just as in the case of the first-order sum rule, the second-order rule can be applied separately to the individual symmetry classes common to all of the molecules. It is shown that the second-order sum rules for a homologous series of isotopic molecules can be found easily by a simple tabulation of the interactions between the equivalent isotopic atoms. Interaction tables are given for the deutero-ethylenes and the deutero-benzenes. The second-order sum rule is used to derive the second rule of the mean for isotopic exchange equilibria. Examples of the latter are given involving the carbon dioxide, ethylene, and benzene molecules. A.

539.19

4377. CHARACTERISTIC FREQUENCIES OF TRIMETHYLBORANE.
W.J.Lehmann, C.O.Wilson, Jr and I.Shapiro.
J. chem. Phys., Vol. 28, No. 5, 777-80 (May, 1958).

Contrary to previously published values, the characteristic B–C asymmetric stretching mode in trialkylboranes is assigned to the 1116 to 1150 cm^{-1} range. The basis for the assignment of the various characteristic bond vibrations is the comparison of the infrared spectrum of trimethylborane-b^{10} with the infrared and Raman spectra of isotopically normal trimethylborane. The new values lead to better consistency with spectra of other trialkylboranes and alkydiboranes. A.

539.19

4378. CHARACTERISTIC FREQUENCIES OF TRIETHYLBORANE.
W.J.Lehmann, C.O.Wilson, Jr and I.Shapiro.
J. chem. Phys., Vol. 28, No. 5, 781-4 (May, 1958).

The infrared spectra of isotopically normal and triethylborane-b^{10} are reported, and the major bands are assigned to the characteristic bond vibrations of the molecules. Analogous to trimethylborane, the asymmetric B–C stretching frequency is placed at ~1120 cm^{-1}. In view of the complexity of the molecule a more complete assignment is not feasible at this time. A.

539.19 : 535.343

4379. ROTATIONAL STRUCTURE OF THE INFRARED ABSORPTION SPECTRUM OF HYDROGEN PEROXIDE VAPOR. E.Hirota.
J. chem. Phys., Vol. 28, No. 5, 839-46 (May, 1958).

The internal rotation of the hydrogen peroxide molecule is treated on the assumption that the hindering potential is approximately expressed by the two-term Fourier expansion: $V = (V_1/2)(1+\cos\chi) + (V_2/2)(1+\cos 2\chi)$. The doublet structure of the infrared absorption spectrum is considered to be caused by the existence of a double minimum in the hindering potential. The available experimental data on the microwave spectra and on the infrared combination bands yield the result of $V_1 = 244$ cm^{-1} (700 cal/mole) and $V_2 = 319$ cm^{-1} (910 cal/mole). Thus it is concluded that the cis barrier (452 cm^{-1} or 1290 cal/mole) is definitely higher than the trans one (208 cm^{-1} or 590 cal/mole). A.

539.19

4380. OUT-OF-PLANE VIBRATIONS OF A CONJUGATED HYDROCARBON: TRANS-BUTADIENE. T.Anno.
J. chem. Phys., Vol. 28, No. 5, 944-9 (May, 1958).

A method of obtaining some of the out-of-plane force constants in conjugated hydrocarbons from bond orders and of borrowing the other kinds of these constants from similar molecules is described. The method includes the assumptions that the force constant of torsion around the CC bond is proportional to the product of the π bond order and the overlap integral of the carbon $2p\pi$ atomic orbital and that the interaction constant between wagging motion of a CH group and a torsion around a CC bond to which the CH group is attached is proportional to the diagonal constant of the torsion.

The validity of these assumptions is discussed. As an application of the method the nonplanar frequencies of trans-butadiene are calculated and compared with experimental values. A.

539.19 : 535.343

4381. INDUCED INFRA-RED ABSORPTION IN GASES. CALCULATION OF THE BINARY ABSORPTION COEFFICIENTS OF SYMMETRICAL DIATOMIC MOLECULES. J.van Kranendonk.
Physica, Vol. 24, No. 5, 347-62 (May, 1958).

The theory developed in a previous paper (Abstr. 3417/1958) is applied to the induced fundamental rotation–vibration band of hydrogen in the pure gas and in mixtures. Expressions are derived for the binary absorption coefficients of the rotational branches in terms of the expansion coefficients of the induced moment of a pair of molecules in products of spherical harmonics of the orientations of the molecules. For the dependence of the induced moment on the orientations of the molecules and on their separation R, a model is constructed, in which a short-range angle-independent overlap moment, decreasing exponentially with increasing R, is combined with a long-range moment proportional to R^{-4} and with an angular dependence characteristic for quadrupolar induction. Expressions are derived for the binary absorption coefficients in terms of the parameters of this (exp-4) model. Experimental values of the parameters λ and ρ, giving respectively the magnitude and the range of the short-range moment, can be obtained from measurements of the total binary absorption coefficient and its temperature dependence. Detailed calculations are presented of the absorption coefficients of pure hydrogen, based on the (exp-4) model for the induced moment and the Lennard-Jones model for the potential of the intermolecular forces, and a comparison of theoretical and experimental results is given. The binary absorption coefficients of mixtures of hydrogen with He, Ne, N_2, A, Kr and Xe are also discussed. On the basis of the assumption that the reduced range ρ/σ is the same for all the mixtures considered here, where σ is the collision diameter occurring in the intermolecular potential, values of λ are obtained for H_2–He, H_2–H_2 and H_2–A by fitting the calculated absorption coefficients to the experimental values. A relation is established between λ^2 and ϵ, the parameter determining the magnitude of the intermolecular potential, enabling one to obtain values of λ for the mixtures H_2–Ne, H_2–Kr and H_2–Xe, and thus to predict the binary absorption coefficients for these mixtures. The value of λ obtained for H_2–N_2 combined with the experimental value of the absorption coefficient, leads to a value of the quadrupole moment of the N_2 molecule equal to 1.2 ea_0^2, in good agreement with the value of 1.1 ea_0^2 obtained from microwave broadening experiments. A.

539.19

4382. A NOTE ON TA-YOU WU'S METHOD OF CALCULATING OVERLAP INTEGRALS FOR MORSE OSCILLATOR.
N.R.Tawde and M.I.Savadatti.
Proc. Phys. Soc., Vol. 71, Pt 3, 514-15 (March, 1958).

Franck–Condon factors for the bands v' = 0,1; v'' = 0-5 of the $O_2^+(A^2\Pi u - X^2\Pi g)$ system were re-evaluated by the method of Wu (Abstr. 2593/1953). R.W.Nicholls

539.19

4383. ELECTRONICALLY EXCITED SPECIES. J.W.Linnett.
Nature (London), Vol. 181, 320-1 (Feb. 1, 1958).

An account of a symposium on "The structure and reactivity of electronically excited species", Ottawa, September 1957. Among the problems under discussion were the following: (1) Recent work on C_2H_2, HCN, CS_2 which are linear in the ground state and bent in the first excited state. (2) Interaction between electronic and vibrational motion in polyatomic molecules — theory of the Jahn–Teller effect, Renner effect in linear molecules and transfer of electronic and vibrational energy between weakly coupled systems. (3) Excited states of ions, multiplicities of excited states of molecules and calculation of energies of excited states. (4) Participation of excited species in reactions. Some papers presented at this symposium are published in Canad. J. Chem., Vol. 36, No. 1, 1-166 (Jan., 1958). R.C.Seymour

539.19

4384. STUDIES OF THE JAHN–TELLER EFFECT. II. THE DYNAMICAL PROBLEM.
H.C.Longuet-Higgins, U.Öpik, M.H.L.Pryce and R.A.Sack.
Proc. Roy. Soc. A, Vol. 244, 1-16 (Feb. 25, 1958).

Jahn and Teller (1937) proved that if a symmetrical non-linear molecule has a spatially degenerate electronic state then in this state it will tend to distort in such a way as to remove the electronic degeneracy. In Pt I the static aspects of this effect were surveyed and the form of the distortion was studied in some particular cases (for Pt I see Abstr. 2395/1957). This paper examines the vibronic energy levels of a symmetrical non-linear molecule in a spatially doubly degenerate electronic state which is split in first order by a doubly degenerate vibrational mode. The vibronic levels are classified by a quantum number, which in certain cases is formally related to the combined angular momentum of electronic and vibrational motion, and numerical values are obtained for the energies of these levels as functions of this quantum number and a dimensionless parameter measuring the magnitude of the electronic–vibrational coupling. It is shown that the selection rules for transitions from these vibronic levels to those of a non-degenerate electronic state allow changes in vibrational energy of an integral number of quanta, as though the Jahn–Teller effect were equivalent to a distortion which makes allowed vibrational transitions which would otherwise be forbidden. Numerical values are given for the oscillator strengths of vibronic absorption or emission bands involving transitions between a Jahn–Teller distorted state and an electronically non-degenerate state. It is found that in transitions from the latter to the former the vibrational structure of the electronic band exhibits two intensity maxima if the distortion is large. A.

539.19

4385. INHERENT CONFIGURATIONAL INSTABILITY OF OCTAHEDRAL INORGANIC COMPLEXES IN E_g ELECTRONIC STATES. A.D.Liehr and C.J.Ballhausen.
Ann. Phys. (New York), Vol. 3, No. 3, 304-19 (March, 1958).

Van Vleck's treatment of the Jahn–Teller effect in inorganic octahedral complexes having E_g electronic states is modified by the inclusion of additional quadratic terms. This procedure introduces a new constant, β, in terms of which the stereochemical behaviour of d^n, (n = 1, 4, 6, 9), complexes may be understood. It is found that this constant is best viewed as a phenomenological parameter. The theory developed is used to amplify the discussion of the paramagnetic resonance spectrum of copper fluosilicate hexahydrate given by Abragam and Pryce; to explain and predict certain asymmetries in the visible absorption bands of Ti (III), Cr (II), and Co (III), octahedral complexes; and to understand the observed distortions of octahedral Cu (II) and Mn (III) complexes. A.

539.19

4386. SPATIAL DISTRIBUTION OF ELECTRONS IN THE NITROGEN MOLECULE. K.Singh.
Trans Faraday Soc. Vol. 54, Pt 5, 613-16 (May, 1958).

Contour maps of suitably selected equivalent orbitals (ϕs) provide an illuminating picture of the electronic arrangement in a molecule. It is the purpose of this paper to determine the contours of equivalent orbitals in the nitrogen molecule. A.

539.19 : 539.18

ELECTRON CONFIGURATIONS IN GROUND STATE SYSTEMS.
See Abstr. 4365

539.19

4387. PARAMAGNETIC RESONANCE IN TRIVALENT TRANSITION METAL COMPLEXES. H.S.Jarrett.
J. chem. Phys., Vol. 27, No. 6, 1298-304 (Dec., 1957).

Paramagnetic resonance absorption was observed in complexes of acetylacetone with the trivalent transition metals titanium, chromium, iron, molybdenum, and ruthenium. The symmetry of the field perturbing the metal ion is predominantly axial. For the complexes of Ti^{+3} and of Ru^{+3}, the axial potential is negative. Energy-level splittings by the ligand field and g factors were obtained for the various complexes. Resonance was also observed in complexes of trifluoroacetylacetone with chromium and iron and in the complex chromium (III) hexafluoroacetylacetonate. Resonance could not be detected in the complexes vanadium (III) acetylacetonate, manganese (III) acetylacetonate and ferric (III) hexafluoroacetylacetonate, although magnetic-susceptibility measurements on the last two compounds indicated that they were paramagnetic. A.

539.19

4388. PARAMAGNETIC RESONANCE SPECTRA OF SOME SEMIQUINONE FREE RADICALS.
M.Adams, M.S.Blois, Jr and R.H.Sands.
J. chem. Phys., Vol. 28, No. 2, 774-6 (May, 1958).

The spectra were obtained using a microwave E.S.R. spectrometer. The character of the hyperfine structure, splitting constants, and g values for these radicals are tabulated. A.

539.19

4389. NUCLEAR MAGNETIC RESONANCE IN THE CESIUM HALIDES. N.Bloembergen and P.P.Sorokin.
Phys. Rev., Vol. 110, No. 4, 865-75 (May 15, 1958).

The chemical shifts, the spin—lattice relaxation times, the isotropic exchange coupling $\tilde{A}$, and the pseudo-dipolar exchange coupling $\tilde{B}$ between cation and anion nuclear spins were determined in a single crystal of CsBr. The results are: $\sigma_{Cs} = (-1.9 \pm 0.4) \times 10^{-4}$, $\sigma_{Br} = (-2.5 \pm 0.3) \times 10^{-4}$, $(T_1)_{Cs} = 1050 \pm 40$ sec, $(T_1)_{Br} = 0.105 \pm 0.020$ sec, $h^{-1}|\tilde{A}| = 55$ sec^{-1}, $h^{-1}\tilde{B} = 15$ or -89 sec^{-1}. Similar, but less complete, data were obtained for a single crystal of CsI and a CsCl powder. The results are discussed in terms of existing theories for the chemical shift and exchange interactions in solids. An average of 25% covalent bonding per ion is deduced. The large ratio of T_1 for Cs and Br, respectively, sets an upper limit to the quadrupole moment of Cs^{133}: $|Q| < 0.004 \times 10^{-24}$ cm^2. This large difference in the spin—lattice interactions between the nuclear species is responsible for some new effects. The decay time T_{2e} for the transverse Cs^{133} magnetization is proportional to $H_1^2(\nu_{Cs})$ for a wide power range of the radiofrequency field at the Cs^{133} Larmor frequency. It is furthermore possible to build up a transverse Cs^{133} magnetization by applying, simultaneously with $H_1(\nu_{Cs})$, a radiofrequency field $H_1^{Br}(\nu)$ at a frequency $\nu = \nu_{Br} \pm \gamma_{Cs} H_1^{Cs}/2\pi$. Here ν_{Br} is the bromine precession frequency. A theory of these effects shows that the relatively weak interaction constants $\tilde{A}$ and $\tilde{B}$ between caesium and halogen spins can be determined with much higher accuracy than would have been possible from the usual second moment determinations. A.

539.19

4390. CONFIGURATION INTERACTION STUDY OF THE ELECTRONIC STRUCTURE OF THE OH RADICAL BY THE ATOMIC AND MOLECULAR ORBITAL METHODS. A.J.Freeman.
J. chem. Phys., Vol. 28, No. 2, 230-43 (Feb., 1958).

The role played in configuration calculations by the particular form of the orbitals selected as basis is explored by a direct application on the electronic structure of the ground state of the OH molecule. Two configuration interaction studies are carried out using different sets of one-particle functions: (1) the set natural to the isolated atoms (called AO's) and (2) the orbitals belonging to the molecule (MO's). On (1), using the Hartree—Fock 1s, 2s, and 2p functions for atomic oxygen and the 1s state for hydrogen, and keeping the 1s oxygen state doubly occupied, all Slater determinants of the appropriate ground state symmetry ($^2\pi$) were found. The dissociation energy and the expansion coefficients of the determinants were determined by a variational procedure which minimized the energy of the system. The nonorthogonality of the basic AO's was treated without approximation by the method of Löwdin. The necessary integrals were calculated on Whirlwind I, the M.I.T. high-speed digital computer; all two-centre integrals were computed by expanding the hydrogen orbital about the oxygen centre (analogously to the methods of Barnett and Coulson, Coolidge, Löwdin, etc.). In (2), the molecular orbitals (MO's) were found as linear combinations of the above AO's, with coefficients determined by a modified self-consistent field (Roothaan) procedure, in which the energy of a single Slater determinant was made stationary at three values of the internuclear separation. A configuration interaction calculation was then made using these "best" MO's as the basic set of one-particle functions. Also included are a calculation of the dipole moment and Mulliken's electron distribution analysis. The results of these studies are discussed and comparison is made to experiment and other theoretical calculations. A.

539.19

4391. FLOATING WAVE FUNCTIONS FOR H_2^+ AND H_2.
J.Shull and D.D.Ebbing.
J. chem. Phys., Vol. 28, No. 5, 866-70 (May, 1958).

Floating wave-functions using ordinary 1s orbitals are reexamined for both H_2^+ and H_2. Results previously reported in the literature are found to be in error. The newly obtained energies are disappointingly high. It is conjectured that these relatively poor energies are largely the result of the inability of this kind of approximation to give a good representation of the discontinuities in the wave-function in the vicinity of the nuclei. A.

539.19 : 541.57

4392. SOME COMMENTS ON THE STRENGTH OF SINGLE COORDINATE BONDS. W.S.Fyfe.
J. chem. Phys., Vol. 28, No. 5, 907-11 (May, 1958).

The strength of simple coordinate bonds has previously been discussed emphasizing the importance of ionization potentials of donor and acceptor species. This treatment neglects an important term in the thermodynamic cycle, the homolytic dissociation energy which in many cases dominates. Some anomalies following neglect of this term are attributed to multiple bonding and it is considered that the extent of such bonding may have been overestimated. A.

539.19

4393. ANTISYMMETRIZED HÜCKEL ORBITAL CALCULATIONS OF IONIZATION POTENTIALS AND ELECTRON AFFINITIES OF SOME AROMATIC HYDROCARBONS. R.M.Hedges and F.A.Matsen.
J. chem. Phys., Vol. 28, No. 5, 950-3 (May, 1958).

Calculations have been made for twenty-three condensed-ring aromatic molecules. In these calculations differential overlap is neglected. The calculated ionization energies together with the polariographic reduction potentials permit the estimation of solvation energies of molecular ions. A.

539.19

4394. FORMAL HÜCKEL THEORY. W.T.Simpson.
J. chem. Phys., Vol. 28, No. 5, 972-4 (May. 1958).

Using the nondiagonal potential energy operator

$$U_\nu = -\sum_i (1/r_{\nu i}) + \sum_i \varphi_i(x_\nu')\varphi_i(x_\nu)X_{\nu i} - \\ - (1/2)\sum_{i \neq j} \varphi_i(x_\nu')\varphi_j(x_\nu)(X_{\nu i} + X_{\nu j})(\Delta_\nu)_{ij},$$

where

$$X_{\nu i} = \int \varphi_i(x_\nu) \sum_{k \neq i} (1/r_{\nu k})\varphi_i(x_\nu)d\tau$$

and

$$(\Delta_\nu)_{ij} = \int \varphi_i(x_\nu)\varphi_j(x_\nu)d\tau$$

(and the φ's are atomic orbitals) the Hückel theory may be formally stated. The formal theory is consonant with the idea of the Fermi hole. Since it is presented as the zeroth-order part of a perturbation theoretical treatment of the true Hamiltonian the perturbation is explicitly known by difference. A.

539.19

4395. A METHOD FOR CALCULATING THE FIRST ORDER PERTURBATION OF AN EIGENVECTOR OF A FINITE MATRIX, WITH APPLICATIONS TO MOLECULAR-ORBITAL THEORY.
R.D.Brown and I.M.Bassett.
Proc. Phys. Soc., Vol. 71, Pt 5, 724-32 (May, 1958).

The first-order perturbation, c', of an eigenvector c of a symmetric matrix H satisfies the inhomogeneous equation

$$(H - y\mathbb{I})c' = -(H' - y'\mathbb{I})c,$$

where I is the unit matrix, y the eigenvalue belonging to c, and the prime denotes the appropriate derivative. The derivative c' can be determined from y, y', c, and a particular solution of the inhomogeneous equation; a convenient computational procedure is demonstrated. In contrast, the conventional perturbation theory requires knowledge of a complete set of eigenvectors of H. Another advantage of the present method is that arithmetic checks are easily applied in numerical work. The method lends itself to the calculation of polarizabilities in the simple molecular-orbital theory. In this connection a complication associated with partly occupied degenerate orbitals is pointed out; the present method is convenient for dealing with this complication. A more rapid method of reducing a matrix by use of symmetry than that commonly used is presented. It is useful in the present perturbation problem but it should prove equally convenient in other problems. The determination of c' in certain cases of degeneracy is described and an error in the literature pointed out. The analysis throughout is general, and may be of interest outside molecular-orbital theory. A.

539.19

4396. THE DETERMINATION OF INTERATOMIC DISTANCES FROM THE ROTATIONAL SPECTRUM.
W.A.Cunha and S.Pereira da Silva Porto.
An. Acad. Brasil. Ciênc., Vol. 29, No. 3, 323-7 (1957).
In Portuguese.

539.19 : 537.226.1.08

RANGE OF VALIDITY OF HIGASHI'S EQUATION FOR A QUICK DETERMINATION OF DIPOLE MOMENT IN SOLUTION.
See Abstr. 3970

539.19

4397. RESTRICTED ROTATION PARAMETERS FROM THE DIPOLE MOMENTS OF α,ω-DIBROMOPARAFFINS.
H.J.G.Hayman and I.Eliezer.
J. chem. Phys., Vol. 28, No. 5, 890-2 (May, 1958).

The theory of hindered rotation previously used for calculating the mean square length of polymer molecules has been combined with the Smith, Ree, Magee, and Eyring theory of the inductive effect to obtain a two-parameter expression for the dipole moment of α,ω-dibromoparaffins. The values which must be assigned to

these parameters to give agreement with experiment indicate an intermediate degree of freedom of internal rotation in these molecules. A.

539.19

4398. MOTIONAL CORRECTIONS TO DISTANCES DERIVED FROM N.M.R. DATA: NH_4Cl, NH_4F, AND $N_2H_6F_2$.
J.A.Ibers and D.P.Stevenson.
J. chem. Phys., Vol. 28, No. 5, 929-38 (May, 1958).

Corrections for the effects of zero-point energy vibrations on the second moments of the nuclear magnetic resonance (N.M.R.) spectral lines of NH_4Cl, NH_4F, and $N_2H_6F_2$ are considered in detail and new N—H distances are derived. It is found for these particular substances that the corrections to the second moments for liberational motions are relatively more important than corrections for bending or stretching motions. It is also found that because of the anharmonicity of the stretching motion the error involved in replacing the derived average of the distance by the equilibrium distance is relatively small. A.

539.19

4399. ELECTRON DIFFRACTION STUDY ON THE ROTATIONAL ISOMERISM IN n-PROPYL CHLORIDE. Y.Morino and K.Kuchitsu.
J. chem. Phys., Vol. 28, No. 2, 175-84 (Feb., 1958).

The molecular structure and the rotational isomerism of n-propyl chloride were investigated by means of the sector-microphotometer method of electron diffraction. The following structural parameters were obtained: C—Cl = $1.77_8 \pm 0.02$ A; C—C = $1.53_8 \pm 0.02$ A; and $\angle$C—C—Cl = $111^\circ \pm 2^\circ$. It was confirmed that there are two isomers in the vapour phase; one is the trans-form, and the other is the gauche-form. From the analysis of the scattering intensity of the small-angle region ($q = 5 \sim 15$), the angle of $\angle$C—C- C, the azimuthal angle of the gauche-form, and the fraction of the trans-form were found to be $109.5^\circ \pm 2.5^\circ$, $59^\circ \pm 5^\circ$, and $19 \pm 5\%$, respectively. It was also found through the calculation of the partition functions that the gauche-form is only a few hundred calories/mole more stable than the trans-form, in fairly good agreement with the spectroscopic results. The procedure used in the analysis of the small-angle region is described in detail. A.

539.19 : 535.434

4400. LIGHT SCATTERING AND STATISTICAL SHAPE OF STREAMING FREELY FLEXIBLE LINEAR MACROMOLECULES.
A.Peterlin, W.Heller and M.Nakagaki.
J. chem. Phys., Vol. 28, No. 3, 470-6 (March, 1957).

The angular distribution of the light scattered from an unpolarized beam by a solution of random coils subjected to shear is calculated. The molecular model considered is a freely draining coil and the light scattering is treated according to Debye. The theory shows that the probability distribution of the segments at finite shear has the symmetry of an ellipsoid whose axial ratio increases with shear. The results derived should allow one to determine the mean square end-to-end distance, its variation with the shear applied and, therefore, the statistical shape of flexible macromolecules and its change by flow. A.

539.19

4401. CHAIN CONFIGURATIONS OF POLYMERS AND POLYELECTROLYTES. M.E.Fisher.
J. chem. Phys., Vol. 28, No. 5, 756-61 (May, 1958).

On the basis of a rigorous statistical mechanical approach it is shown that the treatments of the configuration of a polyelectrolyte molecule given by Katchalsky and Lifson and by Krieger are equivalent to retaining only the first-order term of the high temperature expansion of the free energy. Katchalsky's and Lifson's more accurate calculation is exact in the limit of a "continuous" chain but the neglected correction terms are shown to be significant. Krieger's approximate expression for the first-order term is only valid for highly stretched chains and it predicts incorrect results when the interaction potential is appreciable near the origin. A.

539.19

4402. CHAIN STIFFNESS AND THE LATTICE THEORY OF POLYMER PHASES. E.A.DiMarzio and J.H.Gibbs.
J. chem. Phys., Vol. 28, No. 5, 807-13 (May, 1958).

General formulae for the thermodynamic properties of amorphous polymer phases are obtained from statistical mechanics, with the aid of the lattice model, in a manner which avoids the use of restrictive assumptions concerning the nature of the individual polymer chains. Certain results, such as prediction of a second-order transition for systems of semiflexible chains and the Flory—Huggins formula for the entropy of mixing with monomeric solvent, are thus shown to be independent of the precise nature of the model assumed for the polymer chains. More complete information may be obtained by application of the general formulae to models descriptive of the molecular chains in question. As an example, the results of Flory for semiflexible linear chains whose stiffness arises exclusively from intramolecular nearest neighbours are obtained as a special case. (The conventional thermodynamic properties of polydisperse systems of chains of this type are shown to depend on the number average molecular weight). A.

539.19

4403. INTERMOLECULAR REPULSIVE FORCES. T.L.Cottrell.
Disc. Faraday Soc., No. 22, 10-16 (1956).

The theoretical and experimental evidence on intermolecular repulsive forces is summarized and discussed. It is shown that at close range an inverse power law is inadequate to represent the repulsive potential, whereas an exponential fits the results tolerably well. Information about the equilibrium properties of gases at ordinary temperatures and pressures is almost irrelevant to the discussion of intermolecular forces and the discussion of matter at high density is obscured by the need to take into account many-body forces so that the study of high-energy elastic collisions gives most information about the repulsive potential. Valuable empirical information may, however, be obtained from the study of matter at very high pressure, using new techniques of measurement. A.

539.19

4404. THE DIFFERENCE IN THE INTERMOLECULAR FORCES OF H_2O AND D_2O. E.Whalley.
Trans Faraday Soc., Vol. 53, Pt 12, 1578-85 (Dec., 1957).

The lattice energy of a compound at $0^\circ K$ can be obtained from the heat of sublimation at $0^\circ K$, the zero-point energies due to the various intermolecular vibrations, and the difference between the crystal and the gas in the intramolecular zero-point energies. The difference in the lattice energies of isotopic molecules which have the same crystal structure is a good measure of the difference in their intermolecular forces. The lattice energy of H_2O and the difference in lattice energies of H_2O and D_2O were calculated from calorimetric and spectroscopic data. The lattice energy of D_2O at $0^\circ K$ is higher than that of H_2O by 1.27 ± 0.6 kJ mol^{-1}. The difference is presumably due to the different intermolecular forces consequent on the anharmonic zero-point intramolecular vibrations, and the difference of dipole moments is probably the major contribution. This is the first clear evidence that isotopic molecules may have appreciably different intermolecular forces. The lattice energy of ice at $0^\circ K$ is higher than is usually assumed because of the difference of zero-point energies between the solid and the vapour, and it amounts to 56.0 ± 0.7 kJ mol^{-1}. Most of the assigned error is caused by the uncertainties in the distribution of intermolecular rotational frequencies. A.

SOLID-STATE PHYSICS

539.2

4405. EQUATION OF STATE OF ZINC, CADMIUM AND MAGNESIUM. S.S.Tolpadi.
Proc. Phys. Soc., Vol. 71, Pt 5, 742-8 (May, 1958).

A method of deriving the equation of state of crystals belonging to the hexagonal system from the experimental data on specific heat, thermal expansion and elastic constants was developed. The method is a modification of the one given by Dayal for cubic crystals. The pressures along the hexagonal axis and those perpendicular to it are divided into two parts, of which the first is the static part due to a non-vibrating lattice and the second due to the thermal vibrations. Two average Grüneisen constants were calculated from the experimental data and have been used in the calculation of the thermal pressures, along the two axes. The static pressure for a non-vibrating lattice is calculated as a function of the linear dimension from the condition that for the linear dimension measured at zero pressure, the sum of the thermal and static pressures must be zero. In this way the total pressure comes out to be the difference between the thermal pressure at a temperature T and length l and the one calculated for a temperature at which the crystal has the same length at $P = 0$. Detailed calculations have been made for zinc, cadmium and magnesium. It is found that in all cases, except in the case of cadmium perpendicular to the hexagonal axis, the calculated results are in good agreement with Bridgman's experimental measurements. It is shown that the equation of state derived from the assumption made by Grüneisen about two Debye characteristic temperatures,

one perpendicular and the other parallel to the hexagonal axis, does not agree with the experimental observations made by Bridgman. A.

539.2 : 536.791

GRÜNEISEN'S LAW AND THE THIRD LAW OF THERMODYNAMICS. See Abstr. 3962

539.2 : 536.421

4406. CORRESPONDENCE IN SOME CRYSTALLINE SOLIDS AT THEIR MELTING POINTS. R.Gopal.
Trans Faraday Soc., Vol. 53, Pt 4, 406-9 (April, 1957).

The study of relationship between the lattice energy ($-U_0$) and the melting point T_m in a set of similar crystalline substances was extended to some molecular solids in which dispersion forces are predominant and the force-fields are spherically symmetrical (or very nearly so) around the molecules, e.g. H_2, N_2, CO, etc. It is found that the zero-point energy does not have a very marked effect on the ratio $-U_0/T_m$, which is approximately constant even without making quantum corrections in most cases examined. For solid hydrogen, a quantum correction is required. The constancy appears to be due to existence of near correspondence at the melting points. Further, it was shown that this constancy leads to an approximate value 0.438 for the reduced melting point T_m/T_c in different cases. Heats of sublimation at 0°K were estimated for certain spherically symmetrical molecular solids from the formula $\Delta H^0_{sub} \cong 31\ T_m$, and it was shown that these values agree roughly with those calculated from Lennard-Jones 12 : 6 potential function in some cases. The estimated values are, however, in much better agreement with those calculated from the experimental data on solid-vapour equilibrium compiled by Stull (Abstr. 1856/1947). A.

539.2 : 548.737

ON THE LATTICE VIBRATIONS OF BENZENE, NAPHTHALENE AND ANTHRACENE. See Abstr. 3593

539.2

4407. AN INVESTIGATION OF THE DEPENDENCE OF THE BINDING FORCE ON THE CRYSTAL COMPOSITION IN METALS AND SOLID SOLUTIONS. V.A.Il'ina, V.K.Kritskaya, G.V.Kurdyumov, Yu.A.Osip'yan and T.I.Stelletskaya.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 3, 417-31 (1957).
In Russian.

The crystals studied included members of the systems Fe-Cr, Fe-W, Fe-Mn and Fe-Ti as well as pure Cr, Ta and W. In each case the variation of the interatomic binding,as measured by the Debye characteristic temperature θ and Young's modulus E, was determined before and after plastic deformation or thermal treatment. Results were: (1) For pure Fe, Mo, W and Ta, θ is unaffected by deformation or thermal cycling. (2) Heating of deformed pure Cr to 600°C gives a measurable rise of θ; heating of similarly deformed Cr to 800°C gives no effect; the change of θ, when observed, is reversible. (3) For the alloys, θ is increased by heating but reduced by either plastic deformation or quenching. Discussion relates the changes of θ and E to changes in short-range order; greater order gives tighter binding. 24 references. A.F.Brown

539.2 : 535.345

4408. THEORY OF EXCITON ABSORPTION OF LIGHT.
S.V.Vonsovskii, V.I.Cherepanov and V.S.Galishev.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 2, 205-11 (1957).
In Russian.

A theoretical paper. The process of absorption of light in crystals was studied using generalized Frenkel's theory of exciton excited states due to V.S.Galishev and S.V.Vonsovskii (Fiz. Metallov i Metallovedenie, Vol. 3, 395, 1956). The probability of a quantum transition from the ground state to an excited state was found for a system of electrons under the action of light. It is shown that optical properties of such a system at the absolute zero of temperature are not completely identical with properties of a system of isolated particles. When the exchange and pair processes are neglected in the mechanism of electron excitation the theory used here becomes identical with Frenkel's theory. S.Chomet

539.2 : 535.345

4409. THE POSSIBILITY IN PRINCIPLE OF AN "INTRAZONAL" MECHANISM FOR LIGHT ABSORPTION IN SOLIDS.
V.I Cherepanov.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 2, 212-15 (1957).
In Russian.

A theoretical paper. A preliminary consideration of the problem based on a many-electron selection rule for the optical transitions of a system of interacting electrons in a crystal. It is concluded that an "intrazonal" mechanism could account for light absorption in solids, but the transition probability should be calculated for a concrete many-electron model. C.R.S.Manders

539.2 : 538.221

4410. THE ELECTRONIC STRUCTURE OF NICKEL AND ITS ALLOYS. G S.Krinchik.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 1, 36-40 (1957).
In Russian.

On the assumption that Ni has 0.47 3d-holes/atom and 0.13 4s-electrons/atom, the magnetic properties of Ni and Ni-based alloys can be satisfactorily explained theoretically. The assumption can be further tested by measurement of the spectroscopic splitting factor (g) and paramagnetic susceptibility of Ni_3Mn. A further proof of the same assumption by the optical method of Roberts (Abstr. 1122/1956) is acknowledged in a note added in proof. A.F.Brown

539.2

4411. THE ELECTRONIC STRUCTURE OF CRYSTALS HAVING THE SODIUM CHLORIDE TYPE OF LATTICE. T.B.Grimley.
Proc. Phys. Soc., Vol. 71, Pt 5, 749-57 (May, 1958).

The electronic structure of an ionic crystal is investigated with the assumption that the solutions of Fock's equations for the valence electrons can be expressed as linear combinations of the outer orbitals on the negative ions and the first vacant orbitals on the metal ions. The inclusion of this latter group of orbitals allows for homopolar binding. Numerical calculations are made for LiF and the width of the F^- 2p band is found to be 5.4 eV, of which about 5% is due to homopolar binding. The main homopolar effect is to provide a coupling between ions which are second-nearest neighbours in the halide-ion lattice. A.

539.2

4412. CALCULATION OF ENERGY BANDS IN A SOLID WITH SPIN–ORBIT INTERACTION. D.Saint-James.
C.R. Acad. Sci. (Paris), Vol. 246, No. 10, 1533-5 (March 10, 1958).
In French.

The augmented plane-wave method of calculating electronic energy bands is extended to include a spin–orbit interaction term in the radial wave equation. D.M.Edwards

539.2

4413. THE DESCRIPTION OF ELECTRONIC STATES IN A CUBIC CRYSTAL. A.V.Sokolov and V.P.Shirokovskii.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 1, 3-8 (1957).
In Russian.

The electronic wave-functions and energy states are derived solely from the conservation laws and the symmetry properties of the crystal. The results are tabulated. A.F.Brown

539.2

4414. THE ENERGY OF AN ELECTRON IN AN ALMOST-PERIODIC FIELD. I. A.I.Rezanov.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 1, 14-16 (1957).
In Russian.

An application of Rezanov's method of expanding the lattice field of a real crystal in a Fourier series of almost-periodic functions (ibid., Vol. 3, No. 1, 11, 1956). The energy spectrum of an electron in such a field has the form of two series of regions of discrete energy values. A.F.Brown

539.2

4415. ON THE POSSIBLE SHAPE OF THE SURFACE OF CONSTANT ELECTRON ENERGY IN THE PERIODIC FIELD OF THE LATTICE. G.E.Zil'berman and Ya.E.Aizenberg.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 2, 216-21 (1957).
In Russian.

Fermi surfaces are calculated for cases when the electrons obey more complex dispersion relations than are usually considered. Small groups of electrons can give complex multiply-connected constant energy surfaces. Holes can exist even in zones which are not nearly full. A selection of the surfaces computed are shown in isometric and contour drawings. A.F.Brown

539.2

4416. THE BAND THEORY OF METALS. V.Heine.
Nature (London), Vol. 181, 525-7 (Feb. 22, 1958).

Report of a Physical Society conference on band theory and the structure of the Fermi surface, held at Imperial College, London, on 19-20 December 1957. Nineteen papers were presented, divided about equally between theoretical discussions of ferromagnetism, correlation effects, superconductivity and other topics, and experi-

mental investigations of the Fermi surface and of parameters determined by it. R.G.Chambers

539.2

4417. CONTRIBUTION TO THE THEORY OF THE SURFACE ELECTRONIC STATES IN THE ONE-ELECTRON APPROXIMATION. J.Koutecký.
Phys. Rev., Vol. 108, No. 1, 13-18 (Oct. 1, 1957).

A formal treatment is given of the surface states associated with a semi-infinite crystal. The treatment assumes that the surface states are produced by a potential which is a function only of the distance from the surface but is otherwise unspecified. A formal expansion is made in a complete set of Wannier orbitals, but the conclusions of the paper are based on the assumptions that (a) it is sufficient to use the orbitals of a single band and (b) the tight-binding approximation is adequate for that band. Some theorems are given on the localization of Wannier orbitals, the localization of surface states, and the number of surface states for a given penetration of the surface potential. A.

539.2

4418. PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON ELECTRON TRANSPORT IN METALS AND SOLIDS.
Canad. J. Phys., Vol. 34, No. 12A, 1171-423 (Dec., 1956).

For abstracts see Abstr. 9162, 9174, 9179, 9198, 9289, 9651-4, 9691, 9768 (1957); 169-72, 233, 395-8, 523, 1040-1 (1958).

539.2

4419. ON THE THEORY OF THE ELECTRON PLASMA IN A SOLID. V.L.Bonch-Bruevich.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 3, 546-7 (1957).
In Russian.

The plasmon spectrum is calculated for a non-isotropic solid with arbitrary surface energies. A.F.Brown

539.2 : 537.311.33

4420. HEATING OF THE ELECTRON GAS AND TRANSPORT PROCESSES IN CONDUCTORS. V.P.Shabanskiĭ.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 2, 193-202 (1957).
In Russian.

Since transfer of energy from charge carriers to the lattice proceeds slowly, the charge carriers may be accelerated to velocities corresponding to very high temperatures. New formulae are derived for the transport processes in metals and semiconductors taking account of this effect. A.F.Brown

539.2

4421. ON THE BLOCH INTEGRAL EQUATION AT LOW TEMPERATURES. B.Jakšić.
Nuovo Cimento, Vol. 8, No. 2, 282-9 (April 16, 1958).

It is shown that the Bloch integral equation in the theory of conductivity of metals is equivalent in the first approximation at low temperature to a differential equation on the Fermi surface $E = \zeta$. In the special case $w \ll 1$, the second approximation can also be obtained from a single differential equation. The method is of interest for metals with anisotropic Fermi surfaces. A.

539.2

4422. CHARACTERISTICS OF FREE ELECTRONS IN GRAPHITE FROM A STUDY OF ITS MAGNETIC AND OTHER PROPERTIES. A.K.Dutta.
Physica, Vol. 24, No. 5, 343-6 (May, 1958).

The various parameters of the free electron gas in graphite are deduced from the observation of its magnetic and thermal properties without making assumptions regarding the zone picture for these electrons. The results obtained are discussed in relation to parameters obtained from the de Haas–van Alphen effect. The significance of the values of the parameters deduced are indicated. A.

539.2 : 537.311.33

4423. INTERACTION OF IMPURITY CENTRE ELECTRONS WITH ACOUSTIC VIBRATIONS IN A UNIAXIAL CRYSTAL. L.I.Korovin.
Zh. tekh. Fiz., Vol. 27, No. 5, 905-13 (1957). In Russian.

The stationary states of the system: impurity electron–acoustic lattice vibration, are examined for the case of a uniaxial atomic semiconductor, taking account of the tensor nature of the effective mass of the electron and the dielectric constant of the crystal. Interaction of the impurity electron with two branches of the vibration, assumed to be longitudinal and transverse, is studied. The error associated with similar approximations for hexagonal crystals is investigated. Using a direct variational method and a method of stationary perturbation theory, the energy levels and wave-functions of the ground and first excited states are calculated, as well as the half-width of the corresponding absorption band. J.B.Arthur

539.2

4424. DISLOCATIONS AND POINT DEFECTS. F.C.Frank.
Disc. Faraday Soc., No. 23, 122-7 (1957).

The principal interactions between dislocations and point defects are: (1) for both foreign and indigenous defects — adsorption, facilitated diffusion, facilitated precipitation; (2) for indigenous defects — creation and annihilation. Among examples recently discovered are the following. Dislocations in germanium allow the conversion of copper atoms from interstitial to substitutional solution, with remarkable and otherwise astonishing consequences. Processes making a large and continuing departure from equilibrium in the concentration of indigenous point defects cause characteristic helical distortions of dislocations, or alternatively generate coaxial rings of dislocations. The mechanisms of these processes are discussed. A

539.2

4425. DEFECTS ON A DIPOLE LATTICE. A.Isihara.
J. chem. Phys., Vol. 27, No. 5, 1174-9 (Nov., 1957).

Effects of defects on dipole interactions in a simple cubic lattice are calculated using the spherical model developed by Berlin and Thomsen (Abstr. 8970/1952), Lax, and others. When the concentration of defects is small, thermodynamical functions are linearly dependent on the concentration. The Curie temperature in the three-dimensional lattice is raised or lowered linearly with the concentration according to whether the defects have stronger or weaker dipole interactions with their neighbours than the interactions which the rest of atoms have. Lattice vacancies also reduce the Curie temperature. The specific heat and electric susceptibility of defect lattice are calculated. In the presence of an homogeneous electric field, there exists a critical field which is influenced by defects. A.

539.2

4426. SORET EFFECT IN DOPED IONIC CRYSTALS. R.E.Howard.
J. chem. Phys., Vol. 27, No. 6, 1377-81 (Dec., 1957).

The Soret effect in an ionic crystal of the type MX doped with divalent impurity ions is considered from the point of view of lattice defects. On the assumption that the impurity ions move in the form of tightly bound impurity-vacancy complexes, the relative concentration gradient of impurity ions is expressed in terms of the heat of transport of the complex and in terms of quantities which may be determined from electrical conductivity measurements. Following the kinetic theory of Wirtz, the heat of transport of the complex is simply related to the heats of transport of the elementary jumps involved in the motion of the complex. An estimate is made of the magnitude of the Soret effect in AgBr containing $CdBr_2$. It is found that the relative concentration gradient should be large enough to be measured experimentally. A.

539.2

4427. VACANCIES AND OTHER POINT DEFECTS IN METALS AND ALLOYS. T.Broom.
Nature (London), Vol. 181, 449-51 (Feb. 15, 1958).

Report of a symposium organized by the Metal Physics Committee of the Institute of Metals and held at A.E.R.E., Harwell, on December 9-10, 1957. The six invited papers were on the role of point defects in (1) quench-, irradiation- and fatigue-hardening, (2) the interpretation of various physical properties, (3) diffusion processes, (4) creep, (5) mechanical properties of ionic crystals, (6) the character of the metallic surface. The report of the ensuing discussion includes new experimental results on (1) and (4) in copper. D.M.Edwards

539.2

4428. QUENCHED-IN LATTICE DEFECTS IN GOLD. J.E.Bauerle and J.S.Koehler.
Phys. Rev., Vol. 107, No. 6, 1493-8 (Sept. 15, 1957).

High-purity gold wires of 16 and 30 mil diameters were heated to temperatures in the range from 450°C to 1000°C and then quenched to room temperature in water. The time required for the cooling was between 10 and 50 milliseconds. An increase in the residual resistivity was observed which could be described by the equation $\Delta\rho = A e^{-E_F/KT_Q}$. Here $\Delta\rho$ is the extra resistivity, A is a constant equal to $(4.9 \pm 1.0) \times 10^{-4}$ ohm.cm, E_F is an energy of formation equal to 0.98 ± 0.03 eV, K is Boltzmann's constant, and T_Q is the temperature from which the quench was made. The resistivity increase annealed in the neighbourhood of 40°C with an activation energy for motion ranging from 0.82 ± 0.05 eV for a quench from 700°C to 0.60 ± 0.04 eV for a quench from 1000°C. The annealing kinetics were first order for quenches from 700°C and below but

were more complex for quenches from above this temperature. The "half-anneal" times at 40°C ranged from 140 hr for a quench from 700°C to $\frac{1}{2}$ hr for a quench from 1000°C. During the anneals a decrease in specimen length was observed which was at all times proportional to the decrease of the extra resistivity, both for the quenches having first-order annealing kinetics and those having the more complicated annealing behaviour. The proportionality constant between the resistivity changes and the fractional-length changes was about 1.1×10^{-3} ohm.cm. A.

539.2

4429. CONTINUOUS DISTRIBUTIONS OF DISLOCATIONS. IV. SINGLE GLIDE AND PLANE STRAIN.
B.A.Bilby, R.Bullough, L.R.T.Gardner and E.Smith.
Proc. Roy. Soc. A, Vol. 244, 538-57 (April 22, 1958).

For Pt III see Abstr. 8475 (1956). The theory of the continuously dislocated crystal is applied to discuss the behaviour of a crystal which has deformed by single glide. When the single glide is also in one crystallographic direction only the deformation is two-dimensional, and this situation is treated in detail. The analysis assumes that the dislocations arrange themselves so that they cause no far-reaching stress. A.

539.2

4430. POINT DEFECTS PRODUCED BY IRRADIATION AND THEIR ANNEALING IN IONIC AND COVALENT CRYSTALS.
F.P.Clarke.
Disc. Faraday Soc., No. 23, 141-54 (1957).

Atoms are displaced by interaction with energetic particles and point defects are produced. The diffusion of these defects to normal lattice positions may be described mathematically, using as a basis a simple physical model, and the description obtained in this way accords with certain experimental data. On this treatment the activation energy for movement of any type of defect is considered to be a discrete quantity. Another method of describing these annealing phenomena is based upon the assumption that the rate processes follow a type of equation familiar in gaseous kinetics. It appears that if this description is to accord satisfactorily with certain experiments a distribution of activation energies has to be assumed. These different treatments are contrasted. A.

539.2 : 535.37

EFFICIENCIES AND PHOTOFRACTIONS FOR SODIUM IODIDE CRYSTALS. See Abstr. 3885-6

539.2

4431. A MECHANICAL AND THERMODYNAMICAL THEORY OF NON-LINEAR RELAXATION BEHAVIOUR OF SOLIDS.
H.C.Brinkman and F.Schwarzl.
Disc. Faraday Soc., No. 23, 11-18 (1957).

The theory describes relaxation as a diffusion process of molecular groups over potential barriers. Mechanical and thermodynamic properties resulting from this model are calculated. On the basis of this theory deviations from linearity (i.e. proportionality between stress and strain) may be related to properties of the potential holes and barriers in which the diffusion process takes place. A.

539.2

4432. THE MECHANISM OF LOW TEMPERATURE MECHANICAL RELAXATION IN DEFORMED CRYSTALS.
A.Seeger, H.Donth and F.Pfaff.
Disc. Faraday Soc., No. 23, 19-30 (1957).

A brief discussion is given of the three types of mechanism by which dislocations cause energy losses in crystals (hysteresis, resonance, relaxation). The experimental evidence in particular for the relaxation mechanism, is surveyed. A qualitative description is presented of the mechanism for the so-called Bordoni relaxation peak which is thought to be due to dislocations overcoming the Peierls stress by thermally activated kink formation. The results of detailed calculations on the rate and the activation energy of such a process are also reported. The treatment does not employ the conventional Arrhenius equation, but derives the relaxation time from the theory of stochastic processes. It takes explicit account of the thermal stresses and the radiation losses governing the dislocation movement. The theory is compared with experimental results on metals and with dielectric measurements on quartz. A.

539.2

4433. THE INFLUENCE OF STATIC STRESSES IN THE CRYSTALLINE LATTICE ON THE MECHANICAL PROPERTIES OF ALLOYS. V.A.Pavlov.
Fiz. Metallov i Metallovedenie, Vol. 4. No. 3, 432-8 (1957).
In Russian.

A critical review of the literature relating to the effects of dissolved impurities on the mechanical properties of solids and on the processes of diffusion, recovery and recrystallization. 29 references. A.F.Brown

539.2

4434. CHEMICAL DETERMINATION OF THE OSCILLATOR STRENGTH OF F CENTERS. A.B.Scott and M.E.Hills.
J. chem. Phys., Vol. 28, No. 1, 24-7 (Jan., 1958).

The concentration of F-centres in additively coloured KCl was determined by measuring the amount of hydrogen evolved when the coloured crystal is dissolved in water. This method avoids the uncertainties inherent in previous experiments on the change in acidity occurring upon dissolution. The use of this concentration in the Smakula absorption equation gives the optical oscillator strength f. The value of f, based upon 12 independent experiments, was 1.17 ± 0.15, which disagrees with previously reported values. A.

539.2

4435. SYMMETRY OF THE H CENTER IN KCl AND KBr.
W.D.Compton and C.C.Klick.
Phys. Rev., Vol. 110, No. 2, 349-53 (April 15, 1958).

H centres were produced in KCl and KBr by X-irradiation at temperatures near liquid helium. The symmetry of these centres was determined by observing the dichroism produced in the absorption band after bleaching with polarized H-band light. It was found that the optical dipole moment of the H centre is parallel to ⟨110⟩. The polarized bleaching light tends to reorient the H centres as well as to bleach them. The oscillator strength of the H centre was found to be greater than about 0.3 that of the F centre in KCl and greater than about 0.5 that of the F centre in KBr. A.

539.2

4436. ON THE THERMAL AND OPTICAL EXCITATION OF COLOUR CENTRES. J.H.Simpson.
Proc. Phys. Soc., Vol. 71, Pt 5, 761-9 (May, 1958).

A method of calculating the ground-state thermal dissociation energy and the electronic part of the optical (1s–2p) absorption energy of a colour centre in an ionic crystal is outlined. The electrostatic energy of interaction of the trapped electron and the lattice is determined by the summation of individual terms due to lattice charges and to dipoles induced at the lattice points. Polarizabilities of these dipoles can be determined readily from the results of Mott and Littleton (1938) for NaCl. The calculated thermal dissociation energy for this material is within 10% of the experimental value. A direct comparison with experiment for the optical absorption energy is not possible because of the relatively large lattice oscillator term which is not determined by the present method. A comparison with the results of Huang and Rhys (1950) for KBr indicates, however, that the electronic component of the absorption energy for NaCl here calculated is approximately correct. A.

539.2

4437. AN X-RAY INVESTIGATION OF INTERCRYSTALLINE INTERNAL ADSORPTION IN SILVER-BASED ALLOYS.
V.I.Arkharov and S.D.Vangengeim.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 3, 439-46 (1957).
In Russian.

The materials studied were binary or ternary alloys of Ag with small amounts of Tl, Be, Zn, Pb and Bi. All were subjected to various mechanical and thermal treatments, after which the lattice parameter was measured as a function of grain size. The accuracy of measurement was $\pm(4-6) \times 10^{-4}$ A, about six times less than the observed variations in lattice parameter. Results are given in extensive tables and are explained on the basis that the impurity atoms are preferentially adsorbed on Ag grain boundaries. The resulting intergranular zones are calculated to be several hundred atoms thick. A.F.Brown

539.2

4438. ON THE PROBLEM OF THE FACTORS WHICH INFLUENCE THE INTERNAL ADSORPTION EFFECT IN SOLID SOLUTIONS.
V.I.Arkharov and S.D.Vangengeim.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 3, 447-9 (1957).
In Russian.

A discussion of how internal adsorption (see preceding abstract) is affected by the following considerations: (i) When the concentration (c) of the foreign atoms ≪ solubility limit, the adsorbing regions will have a greater "capacity" for accepting them. (ii) When c > solubility limit, adsorption may require the formation of new phases.

(iii) The allowable concentration of foreign atoms in the adsorbing zones depends on the relative sizes and chemical natures of solute and solvent. (iv) The rate of adsorption depends on the diffusion rate of solute atoms in the solvent. A.F.Brown

539.2

4439. ON THE INFLUENCE OF TEMPERATURE ON THE INTERCRYSTALLINE ADSORPTION EFFECT IN BINARY SILVER-BASED ALLOYS. S.D.Vangengeim.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 1, 174-6 (1957).
In Russian.

A letter briefly reporting some further results (see preceding abstracts). Two specimens of each of a series of Ag alloys were heated to temperatures (T) between 600 and 900°C. One was then quenched, the other slowly cooled. The lattice parameters of the quenched specimens were found to vary linearly with T. This is explained if the foreign element is assumed to diffuse out of the lattice and be adsorbed in the region of the Ag grain boundaries.

A.F.Brown

539.2

4440. DETERMINATION OF THE g TENSOR IN PARAMAGNETIC RESONANCE. J.A.Weil and J.H.Anderson.
J. chem. Phys., Vol. 28, No. 5, 864-6 (May, 1958).

Methods for evaluating the completely asymmetric g tensor for a single crystal from magnetic resonance data are outlined and discussed. A.

539.2 : 539.14

4441. PARAMAGNETIC RESONANCE IN SOME LANTHANON ETHYL SULPHATES. J.M.Baker and B.Bleaney.
Proc. Roy. Soc. A, Vol. 245, No. 1241, 156-74 (1958).

Paramagnetic resonance in rare-earth ions with an even number of unpaired 4f-electrons is discussed with particular reference to experimental results in Pr^{3+}, Tb^{3+} and Ho^{3+} ions in single crystals of the ethyl sulphates. The crystal field theory of Elliott and Stevens (Abstr. 2545, 6950, 7797/1953) is used to interpret the results. Some second-order perturbation mechanisms are considered which give rise to apparent quadrupole and hyperfine structure interactions. The following nuclear data are obtained from these experiments:

Pr^{141}: $I = \frac{5}{2}$; $|\mu| = 3.92 \pm 0.2$ n.m.;
Tb^{159}: $I = \frac{3}{2}$; $|\mu| = 1.52 \pm 0.08$ n.m.;
Ho^{167}: $I = \frac{7}{2}$; $\mu = +3.29 \pm 0.17$ n.m.; $Q = +0.7 \pm 0.7$ barn.

A

539.2

4442. A THEORY OF SPIN–LATTICE RELAXATION IN PARAMAGNETIC SALTS OF IRON GROUP ELEMENTS WITH AN EVEN NUMBER OF ELECTRONS. V.I.Avvakumov.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 2, 193-204 (1957).
In Russian.

A theoretical paper. General formulae are obtained for spin–lattice relaxation times of hydrated paramagnetic salts of all elements of the iron group whose ions have an even number of electrons in the unfilled 3d-shell: Cr^{++}, $Mn^{+++}(3d^4\,{}^5D_0)$ $Fe^{++}(3d^6\,{}^5D_4)$, $V^{+++}(3d^2\,{}^3F_2)$, $Ni^{++}(3d^8\,{}^3F_4)$. S.Chomet

539.2

4443. NUCLEAR MAGNETIC RESONANCE IN INDIUM ANTIMONIDE. I. THE EFFECT OF IMPURITIES. E.H.Rhoderick.
Phil. Mag. (Eighth Ser.), Vol. 3, 545-63 (June, 1958).

A study was made of the effect of impurities on the In^{115} nuclear magnetic resonance in indium antimonide. In n-type (Te-doped) and p-type (Zn-doped) samples, the amplitude and width of the resonance are very sensitive to the presence of donors or acceptors, a concentration of 10^{19} cm^{-3} reducing the maximum of the derivative of the absorption curve by a factor of 10. This is ascribed to broadening arising from the interaction of the nuclear quadrupole moment with the Coulomb field of the ionized impurity atoms. The effect is slightly less pronounced in p-type than in n-type samples, which can be explained by the fact that holes are more effective than electrons in screening the ionic charges, because of their greater effective mass. Assuming the field gradient at a distance r from an ion to be given by $\partial^2V/\partial r^2 = 2\beta e/r^3$, β must be $\cong 350$ to fit the experiments, which implies an "anti-shielding factor" of $\cong 1000$. It is suggested that this large value is associated with the smallness of the forbidden gap in InSb. The replacement of a small fraction of In atoms by Ga in an InSb–GaSb mixed crystal has a qualitatively similar effect on the In^{115} resonance, but the concentration of Ga atoms must be about 30 times that of Te or Zn for the same reduction in resonance amplitude. Since the Ga atoms are electrically neutral, their effect is attributed to strain set up in the InSb lattice by the disparity betwee the sizes of the Ga and In atoms. A search for a possible Knight shift in n- and p-type InSb containing 10^{19} carriers cm^{-3} revealed n deviation in either case from the In^{115} resonance frequency in intrin sic material, within an experimental accuracy of 1 in 10^4. The negative result in n-type material is attributed to the small effectiv mass of the electrons, which reduces the Pauli susceptibility, while the p-type result provides possible evidence for the p-character of hole wave-functions. A

539.:

4444. NUCLEAR MAGNETIC RESONANCE IN IMPURE INDIUM ANTIMONIDE. M.H.Cohen.
Phil. Mag. (Eighth Ser.), Vol. 3, 564-6 (June, 1958).

An analysis of Rhoderick's experiments (see the preceding abstract) on the nuclear quadrupole broadening of the nuclear magnetic resonance of In^{115} in impure indium antimonide is carried out which is based on a detailed theory of the line shape. It results in values of 580 for the multiplication factor and 1300 for the Sternheimer anti-shielding factor of In in InSb. A

539.2

4445. NUCLEAR RESONANCE SPECTRUM OF Al^{27} IN CHRYSOBERYL. J.H.Hockenberry,Jr, L.C.Brown and D.Williams.
J. chem. Phys., Vol. 28, No. 3, 367-72 (March, 1958).

The nuclear magnetic resonance spectrum of Al^{27} in a single crystal of chrysoberyl ($BeAl_2O_4$)was investigated at room temperature in a field of 7800 gauss. The spectra obtained as the crystal was rotated about the three crystal axes are interpreted on the basis of eight Al^{27} sites of two distinct types, the four sites of each type differing only in the orientation of the principal field gradients. Quadrupole coupling constants and electric field asymmetry parameters at the two types of site were determined to be

	Type I site	Type II site
$C_z = eQ\phi_{zz}/h$	2850 ± 15 kc/s	2846 ± 15 kc/s
$\eta = (\phi_{xx} - \phi_{yy})/\phi_{zz}$	0.94 ± 0.02	0.76 ± 0.02

In addition, the orientation of the principal field gradients has been determined at each of the eight sites. A

539.2 : 539.14

APPLICATIONS OF NUCLEAR MAGNETIC RESONANCE.
See Abstr. 4278

539.21

4446. NUCLEAR MAGNETIC RESONANCE IN IRRADIATED TEFLON. H.Kusumoto.
J. Phys. Soc. Japan, Vol. 12, No. 7, 826 (July, 1957).

The width of the F^{19} resonance curves is increased after deuteron irradiation even if no visible damage is caused. Double bonds formed by cross linkage are believed to disturb the segmental motion of the molecules. (Cf.Charlesby, Abstr. 9712/1954).

J.H.Mason

539.21

4447. RADIATION EFFECTS IN QUARTZ — A BIBLIOGRAPHY. R.Bechmann.
Nucleonics, Vol. 16, No. 3, 122, 138 (March, 1958).

References to change of colour, thermal and electrical conductivity, refractive index and elastic properties due to neutrons, X-rays and γ-rays. R.D.Smith

539.21 : 539.1.07

4448. ELECTRON BOMBARDMENT OF COUNTING DIAMONDS. G.W.Dolphin and K.Stratton.
Proc. Roy. Soc. A, Vol. 244, 424-36 (March 25, 1958).

The effect of 13.5 MeV electron bombardment on the response of diamonds as conduction counters for α- or β-radiation was investigated. The counting-pulse heights decrease progressively with increasing electron bombardment flux until after a total flux of 4×10^{16} electrons/cm^2 they are barely detectable. Both counting and non-counting diamonds also become perceptibly bluish green after bombardment fluxes of this order. The collision model of damage gives a satisfactory interpretation of the general effects of bombardment, and differences between the intrinsic textural defects and those induced by bombardment can be attributed to the presence of interstitial carbon atoms after damage. However, the initial rapid decrease in pulse heights requires an additional disordering mechanism, and it is suggested that preferential damage in the vicinity of intrinsic aggregates of vacant sites may lead to partial graphitization of such regions. A.

539.21 : 539.17

THE EFFECTS OF IRRADIATION ON THE PHYSICAL PROPERTIES OF SOLIDS. See Abstr. 4336

STRUCTURE OF SOLIDS

539.213.1

4449. NATURE OF THE GLASS TRANSITION AND THE GLASSY STATE. J.H.Gibbs and E.A.DiMarzio.
J. chem. Phys., Vol. 28, No. 3, 373-83 (March, 1958).

The thermodynamic properties of amorphous phases of linear molecular chains are obtained from statistical mechanics by means of a form of the quasi-lattice theory which allows for chains stiffness and the variation of volume with temperature. A second-order transition is predicted for these systems. This second-order transition has all the qualitative features of the glass transition observed experimentally. It occurs at a temperature which is an increasing function of both chain stiffness and chain length and a decreasing function of free volume. The molecular "relaxation times" are shown to increase rapidly as the second-order transition temperature is approached from above. To permit quantitative application of the theory and determine the relationship between the second-order transition and the glass transition observed in "slow" experiments these two transitions are tentatively identified. By this means quantitative predictions are made concerning the variations of (1) glass temperature with molecular weight, (2) volume with temperature, (3) volume with molecular weight, (4) volume at the glass temperature with the glass temperature for various molecular weights of the same polymer, (5) specific heat v. temperature, and (6) glass temperature with mole fraction of low-molecular weight solvent, since extensive experimental results are available for these properties. These and other theoretical predictions are found to be in excellent agreement with the experimental results. A.

539.216.1

4450. THE TESTING OF FIBRES AND THEIR MOLECULAR STRUCTURE. P.T.Barrett.
Brit. J. appl. Phys., Suppl. No. 6 (Physics of non-destructive testing), S64-S69 (1957).

In a general survey of fibre physics, advancement in the understanding of the mechanical behaviour of fibres is discussed in the light of recent improvements in techniques for determining the molecular structure of fibres. The introduction of some general aspects of molecular structure is followed by detailed descriptions of new methods of measuring molecular orientation in fibres. The results of dynamic methods of measuring glass–rubber transition temperatures are described and related to the molecular orientation and mechanical behaviour of fibres at various temperatures. Elementary molecular models are introduced to explain certain aspects of the mechanical behaviour of fibres. A.

539.217

4451. DIFFUSION COEFFICIENTS IN SOLIDS, THEIR MEASUREMENT AND SIGNIFICANCE. J.Crank.
Disc. Faraday Soc., No. 23, 99-104 (1957).

The standard definitions and methods of measuring diffusion coefficients in solids are briefly reviewed. Assumptions underlying the simple formulae that have been proposed to relate diffusion coefficients measured by different methods are critically discussed in the light of experimental evidence and theoretical considerations which suggest that modification may be necessary. Difficulties in the way of deciding between several alternative mechanisms for diffusion, and of fully understanding how measured diffusion coefficients are related to the atomic jumps constituting diffusion, are formulated. A.

539.217

4452. SOME FUNDAMENTAL ASPECTS OF THE MECHANISM OF DIFFUSION IN CRYSTALS. K.Compaan and Y.Haven.
Disc. Faraday Soc., No. 23, 105-12 (1957).

Diffusion data, if available in the form $D = D\exp(-E/kT)$, yield two parameters, whereas for a molecular description more quantities are needed. Some difficulties encountered with this problem are discussed. This problem has kinetic as well as equilibrium aspects. The equilibrium aspect has been successfully attacked by the theory of lattice defects: it is possible to specify the atoms that are mobile as well as the frequency with which these mobile atoms jump. Recently, a novel kinetic aspect of the mechanism has become of interest: the problem of correlation between the directions of consecutive jumps of an atom. These correlations effectively alter the self-diffusion coefficient in certain mechanisms, but not the diffusion coefficient for drift or the ionic conductivity. The latter aspect has recently been developed into a promising method of disentangling diffusion mechanisms, especially in ionic crystals. A.

539.217 : 537.311.1

4453. ABNORMAL VALUES OF 'A' AND 'E' IN MIGRATION PROCESSES. A.R.Ubbelohde.
Disc. Faraday Soc., No. 23, 128-32 (1957).

Certain problems are raised about migration mechanisms. No definitive solutions can be presented in most cases. A.

539.217 : 539.165

4454. AN INVESTIGATION OF THE DIFFUSION OF CARBON IN NICKEL AND ITS ALLOYS BY MEANS OF THE RADIOACTIVE ISOTOPE C^{14}. P.L.Gruzin, Yu.A.Polikarpov and G.B.Fedorov.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 1, 94-102 (1957).
In Russian.

The method of diffusion measurements with a radioactive material emitting only weak β-particles is described. Diffusion data are tabulated for C in Ni and in five alloys of Ni. The rate of diffusion of C in Ni does not vary much with addition of up to 5% alloying metal. Diffusion rates of C in Ni and in α-Fe and γ-Fe are compared. A.F.Brown

539.217

4455. ON THE EXCESS VACANCIES PRODUCED IN BRASS AS A RESULT OF EVAPORATION OF THE ZINC (IN A SYSTEM WITH A "SOURCE OF VACANCIES"). Ya.E.Geguzin and N.N.Ovcharenko.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 3, 400-6 (1957).
In Russian.

Zn was evaporated from α-brass by heating at temperatures between 550°C and 820°C. Changes of volume and density were measured as functions of time of heating at constant temp. Hence were calculated the number of vacancies produced by evaporation of Zn and either absorbed in internal pores or expelled from the surface. The calculated porosity was checked metallographically. Results show that nearly all excess vacancies formed by evaporation of Zn above 800°C leave the lattice, and that the concentration of vacant lattice sites (true vacancy concentration) does not vary much with time of heating. A.F.Brown

539.217 : 548.25

4456. AN INVESTIGATION OF THE INFLUENCE OF THE RELATIVE ORIENTATION OF CRYSTALLITES ON THE PROCESSES OCCURRING AT INTERCRYSTALLINE BOUNDARIES. I. A METHOD OF INVESTIGATING THE INFLUENCE OF THE ORIENTATION OF NEIGHBOURING CRYSTALLITES ON INTERCRYSTALLINE DIFFUSION. A.A.Pen'tina.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 3, 536-9 (1957).
In Russian.

The following are described: (1) An X-ray method for determining relative orientation of crystallites. (2) Etchants and techniques for accurate study of chemical diffusion by metallographic methods. Examples given relate to the Cu–Sb system. A.F.Brown

539.217 : 548.25

4457. AN INVESTIGATION OF THE INFLUENCE OF THE RELATIVE ORIENTATION OF CRYSTALLITES ON THE PROCESSES OCCURRING AT INTERCRYSTALLINE BOUNDARIES. II. THE INFLUENCE OF THE RELATIVE ORIENTATION OF CRYSTALLITES ON THE DEGREE OF IRREGULARITY OF DISTRIBUTION OF THE CONCENTRATION OF PYROPHORIC [GOROFIL'NIĬ] IMPURITY, ANTIMONY IN COPPER. V.I.Arkharov and A.A.Pen'tina.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 1, 68-73 (1957).
In Russian.

Diffusion of Ag into pure Ag at 650°C was studied as a function of angle between crystallites ($\Delta\Theta$). (For the method of measuring $\Delta\Theta$ see preceding abstract). Graphical results show two small maxima of the rate of diffusion at $\Delta\Theta \cong 30^\circ$ and $\cong 60^\circ$. Diffusion of Ag into Cu + 0.25% Sb shows maxima in approx. the same positions but ~7 times higher. Analysis of these results shows that diffusion in Cu at 650°C is mainly along grain boundaries. In the Cu–Sb alloy the greatly increased rate of grain boundary diffusion is due to preferential adsorption of Sb at the grain boundaries, thus disturbing the Cu lattice in the intergranular regions. 19 references. A.F.Brown

539.217

4458. THE INFLUENCE OF THE MICROSTRUCTURE ON THE DIFFUSION OF CHROMIUM IN NICKEL-BASED ALLOYS. A.D.Tyutyunnik and G.V.Éstulin.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 3, 558-61 (1957).
In Russian.

A letter describing diffusion experiments on a complex Ni–Cr alloy containing various percentages of Ta. This alloy con-

sists of one phase at temperatures > 950-1000°C; at lower temperatures, complex intermetallic particles are precipitated at grain boundaries. The diffusion coefficient of Cr^{51} in this alloy is tabulated for temperatures 800-1200°C and for concentrations of Ta from 0-6.1%. Since the diffusion coefficient can be used as a measure of the interatomic binding, the results help to predict how the mechanical and thermal properties of these alloys will vary with concentration of Ta. A.F.Brown

539.217

4459. ON THE DIFFUSION OF MERCURY INTO SELENIUM.
A.A.Kuliev and D.N.Nasledov.
Zh. tekh. Fiz., Vol. 28, No. 2, 259-61 (1958). In Russian.

Radioactive Hg^{203} was evaporated on to Se specimens (80-100 μ thick). The Se specimens were prepared by evaporation on to a substrate which was subsequently dissolved away, and were annealed at 130°C and then 200°C for several hours. After the diffusion anneals (at 25, 40, 70 or 100°C), the intensities of β-radiation from the two sides of a specimen were measured, and the diffusion coefficient, D, calculated from the measurements. D was 9×10^{-13} cm²/sec at 25°C and 93×10^{-13} cm²/sec at 100°C. The results (except that at 25°C) fitted the relation $D = D_0 \exp(-E/RT)$, where E was 1.2×10^3 kcal/mole. The 25°C result was smaller than the value given by this relation. K.F.Hulme

539.217 : 539.374

4460. ON THE PROBLEM OF THE INFLUENCE OF PLASTIC DEFORMATION ON THE RATE OF DIFFUSION. A.A.Presnyakov.
Zh. tekh. Fiz., Vol. 27, No. 3, 575-6 (1957). In Russian.

Specimens of nickel of documented (commercial) purity were deformed by rolling and then heated at 700°C in contact with sulphur vapour. Diffusion of S into Ni was measured by metallographic observation of the Ni–S alloy layer under the surface. With heating time (t) of 15 min the thickness (d) of this layer rose slightly with deformation (δ) in the range $0 < \delta < 10\%$, then fell sharply on increase of δ to 25%, vanishing altogether at $\delta \sim 50\%$. With t = 30, 45, 60 min the fall of d with increasing δ was also observed but the effect became less marked as t increased. The author concludes that with some mechanisms of diffusion, lattice disarrangement such as is caused by plastic deformation, may slow up diffusion.

A.F.Brown

539.217 : 536.421.1

MELTING AND DIFFUSION. See Abstr. 3931

539.219 : 537.531 : 539.12

4461. ON THE THEORY OF SCATTERING OF WAVES BY THE CRYSTALLINE LATTICE OF SOLID SOLUTIONS.
V.M.Danilenko, M.A.Krivoglaz, Z.A.Matysina and A.A.Smirnov.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 1, 28-35 (1957).
In Russian.

Equations are derived for the probability of scattering of X-rays, slow neutrons and electrons by departures from local lattice order (substitutional foreign atoms). The calculation is valid for the most general case of a many-component system. A.F.Brown

539.219

4462. ON THE THEORY OF SOLID SOLUTIONS BASED ON THE TRANSITION METALS. I.B.Borovskii and K.P.Gurov.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 1, 187-9 (1957).
In Russian.

Analysis of X-ray and diffusion data on alloys where one component occurs in small concentration (< 1 atomic %) supports the theory of Friedel (Abstr. 408/1955). A.F.Brown

539.219

4463. CHANGES IN THE PROPERTIES AND STRUCTURE OF NICKEL-BASED SOLID SOLUTIONS.
Sh. Sh. Ibragimov and B.G.Livshits.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 2, 315-18 (1957).
In Russian.

The alloys studied were: Ni + 21.4 (by weight)% Cr and Fe + 57.4% Ni + 16.55% Cr. Measurements were made of the electrical resistivity and micro-hardness as functions of the rate of cooling from temperatures above 750°C. Results show that an anomalous diffusion process takes place during cooling. Further experiments including X-ray and electron-microscopical examination show that both alloys exist in two forms. One of them is stable at high temperature and consists of a random statistical distribution of the components on the lattice sites. In the low-temperature form there exist, within the solid solution, non-uniform regions the dimensions of which are comparable with the wavelength of conduction electrons. A.F.Brown

539.219 : 537.311.3

RESIDUAL ELECTRICAL RESISTIVITY OF INTERSTITIAL ALLOYS. See Abstr. 3984

539.232 : 537.226.2 : 535.41

4464. THE DETERMINATION OF THE THICKNESS, DIELECTRI CONSTANT, AND OTHER PROPERTIES OF ANODIC OXIDE FILMS ON TANTALUM FROM THE INTERFERENCE COLOURS. L.Young
Proc. Roy. Soc. A, Vol. 244, 41-53 (Feb. 25, 1958).

The thickness of anodic oxide (Ta_2O_5) films on chemically polished tantalum was determined from the wavelengths of the minima in the specular reflectivity using a value of the refractive index of 2.20 ± 0.02 at 5900 A which was measured on detached flakes of the oxide by the immersion method. An auxiliary measure of increments of thickness was required for the analysis of the spectrophotometric measurements. This was provided by the quantity $(Q\Delta(1/C))$ where Q was the charge which was required to form the increment of thickness, and $\Delta(1/C)$ was the corresponding increase in the reciprocal capacity. This measure of thickness, like that provided by the colours, is independent of the area. The analysis gives the refractive index between 2800 and 6000 A, the net phase-change in the two reflections (with certain assumptions), and a value of ϵ/ρ, where ϵ is the effective dielectric constant under the conditions used, and ρ is the density; ρ was determined by weighing specimens in air and water. The value obtained for ρ was 7.93 (error ± 3%), which gives $\epsilon = 27.6$ (error ± 5%), at 1 kc/s. The effective surface area was the calculated, and was found to be very little different from the apparent area. The field strength during the formation of oxide at 9.55 mA/cm² and 25.8°C was found to be 6.61×10^6 V/cm and to be constant within experimental error, independent of thickness.

A

539.234 : 537.311.31

4465. OBSERVATIONS ON SOME ELECTRICAL PROPERTIES OF EXTREMELY THIN SILVER FILMS. C.Uny and N.Nifontoff.
C.R. Acad. Sci. (Paris), Vol. 246, No. 6, 906-9 (Feb. 10, 1958).
In French.

Reports deviations from Ohm's law and creep effects in 20-30μ Ag films deposited on amorphous silica. Certain procedures for the production of stable layers are described. C.A.Hogarth

539.234 : 541.183.2 : 537.311.3

STRUCTURE OF EVAPORATED BARIUM FILMS. See Abstr. 3983

538.245 : 537.311.33

FERROMAGNETIC SEMICONDUCTORS. See Abstr. 3995

539.234 : 537.311.33

THE EFFECT OF THICKNESS ON THE ELECTRICAL PROPERTIES OF BISMUTH FILMS. See Abstr. 4005

539.262 : 545.82

4466. ELECTRON PROBE X-RAY MICROANALYZER.
L.S.Birks and E.J.Brooks.
Rev. sci. Instrum., Vol. 28, No. 9, 709-12 (Sept., 1957).

A 1 to 13 μ electron probe of simplified design was constructed for X-ray spectrochemical analysis of metallic and non-metallic specimens. At operating conditions of 20 to 30 kV and less than 0.1 μA beam current, counting rates of about 3000 counts/sec were obtained from pure elements such as iron; thus compositions as low as a few tenths percent are detectable. At increased voltage and current and with a beam size of 10 to 23 μ, counting rates may be increased to 50 000 counts/sec. Applications include analysis of inclusions in metals and minerals, mass transfer material from liquid-metal cooling systems, phase composition, and internetallic diffusion studies. A

539.27

4467. OBSERVATION OF METAL SECTIONS BY MEANS OF THE 300 kV ELECTRON MICROSCOPE. H.Tsuchikura and K.Ichige.
Nature (London), Vol. 181, 694-5 (March 8, 1958).

Metal sections 0.5 μ thick were obtained with an improved microtome using a glass knife. The sections were examined in a 300 keV electron microscope. Electron micrographs are shown of aluminium, copper and low carbon steel. It is necessary to etch the sections in hydrochloric acid to thin them down further.

T.Mulvey

539.27

4468. APPLICATION OF THE NICKEL REPLICA METHOD TO THE ELECTRON MICROSCOPICAL IMAGING OF ETCHED POLISHED SECTIONS OF COPPER.
A.Politycki, E.Fuchs and I.Holtermann.

Naturwissenschaften, Vol. 45, No. 3, 55 (1958). In German.

Nickel films, about 50 A thick and deposited electrolytically, were used to replicate polished surfaces of materials like copper. In order to replicate etched surfaces not only are thicker films required, but it is more difficult to separate them from the original. Techniques are described for preparing such replicas.

T.Mulvey

ELASTICITY. STRENGTH. RHEOLOGY

539.313 : 539.89

4469. AN APPARATUS FOR THE INVESTIGATION OF THE MECHANICAL PROPERTIES OF METALS UNDER HIGH HYDROSTATIC PRESSURE. V.A.Gladkovskiĭ and M.I.Oleĭnik.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 3, 531-5 (1957).
In Russian.

A new apparatus is described for obtaining stress/strain curves at pressures up to 10^4 Kg/cm^2. Pressure and test data are recorded oscillographically. Results are shown for a sample of beryllium bronze: at 3000 atm. pressure, the yield stress is about three times that obtained at atmospheric pressure, but the rate of work-hardening is so reduced that the two stress/strain curves would intersect at about 25% extension. A.F.Brown

539.313

4470. STRESS-STRAIN RELATIONS FOR VISCOELASTIC LARGE DEFORMATION. W.Segawa.
J. Phys. Soc. Japan, Vol. 12, No. 9, 996-8 (Sept., 1957).

Stress–strain relations for non-homogenous, three-dimensional and infinitesimal deformations were given by Alfrey (Mechanical Behaviour of High Polymers, 1948) as follows:

$$d\gamma_i/dt = G^{-1}\sum_j a_{ij}dS_j/dt + \eta^{-1}\sum_j a_{ij}S_j \quad \text{for Maxwellian material;}$$

$$\sum_j a_{ij}S_j = G\gamma_i + \eta d\gamma_i/dt \quad \text{for Voigtian material.}$$

The relations corresponding to these two equations are extended so as to be valid for large deformations. For example, the equations for incompressible Maxwellian material having a single relaxation time are as follows:

$$\partial(2\epsilon_{xx})/\partial t = 1/\mu \,.\, \partial/\partial t \,.\, (P_{xx} + \mu\varphi) + 1/\eta(P_{xx} + \mu\varphi),$$
$$\partial(\epsilon_{yz})/\partial t = 1/\mu \,.\, \partial/\partial t \,.\, (P_{yz}) + 1/\eta \,.\, (P_{yz}),$$

and corresponding equations for the other stress components. These equations are then applied to three cases (constant stress, constant strain, and constant strain rate), the results of which can be reduced to those of the ordinary case, if higher terms of strain can be neglected. A.

539.32 : 537.312.62

4471. ADIABATIC YOUNG'S MODULUS AND INTERNAL FRICTION OF SUPERCONDUCTING LEAD AND TIN.
B.Welber and S.L.Quimby.
Acta metallurgica, Vol. 6, No. 5, 351-9 (May, 1958).

Measurements are reported of the Young's modulus and coefficient of internal friction of polycrystalline lead and tin in the normal and superconducting states, and of the variation of these quantities with temperature and strain amplitude. An upper limit is assigned to the existence of a discontinuity in the Young's modulus at the critical temperature. The results are discussed from the viewpoint of the thermodynamics of the superconducting transition. A.

539.32

4472. THE TEMPERATURE DEPENDENCE OF THE INTERNAL FRICTION OF SOME PURE METALS. V.S.Postnikov.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 2, 344-51 (1957).
In Russian.

The damping (Q) due to internal friction was measured as a function of temperature for the following metals: Ti, Ni, Fe, Mo and W. The method used was the torsional pendulum. Results are compared with those of other authors on Sn, Pb, Mg, Ag, Au and Pt, and discussed on the basis of various relaxation mechanisms. Good agreement is obtained with Postnikov's own theory (Zh. tekh. Fiz., Vol. 24, 1599, 1954). A.F.Brown

539.32 : 539.2

4473. THE DEPENDENCE ON ATOMIC NUMBER OF THE SHEARING FORCE OF THE ELEMENTS AT HIGH PRESSURE.
L.V.Vereshchagin and E.V.Zubova.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 1, 171-3 (1957).
In Russian.

The shear modulus (σ) measured at pressures of 25 000-50 000 Kg/cm^2 varies periodically with atomic number and increases with increasing pressure. σ at high pressures appears to vary inversely as the compressibility and to depend only on the number of valence electrons, not on the total number of electrons in the atom, nor on the crystal structure. A.F.Brown

539.32 : 539.219

4474. ON THE THEORY OF THE ELASTIC CONSTANTS OF ALLOYS OF THE β-BRASS TYPE. A.N.Orlov.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 2, 212-19 (1957).
In Russian.

Formulae are derived for the elastic constants C_{11}-C_{12} and C_{44} in terms of the degree of long-range order, departure from stoichiometry and the electrostatic interaction between ions of a CsCl-type lattice. A.F.Brown

539.32

4475. ELASTIC CONSTANTS BY THE ULTRASONIC PULSE ECHO METHOD. S.Eros and J.R.Reitz.
J. appl. Phys., Vol. 29, No. 4, 683-6 (April, 1958).

The elastic constants of single-crystal KCl and NaI were measured by means of the ultrasonic pulse echo method using a wide-band amplifier to display the unrectified echo pattern directly. The experimental results agree with previous measurements made using other techniques. From detailed observations of successive echoes, made possible by the wide-band receiving unit, it was determined that the pulse was attenuated at the front, and at the same time elongated, due to reflection from the specimen-transducer interface. This effect turns out to be just what one would expect theoretically, and is responsible for the so-called "transit-time error". The transit-time error may be as large as one vibration period of the fundamental frequency in the pulse, and is most pronounced for crystal samples in which the acoustic impedance is the same as that of the quartz transducer. A.

539.32 : 534.321.9 : 534.22

ULTRASONIC INTERFEROMETER FOR THE MEASUREMENT OF THE TEMPERATURE DEPENDENCE OF ELASTIC CONSTANTS.
See Abstr. 3807

539.32

4476. DYNAMIC AND STATIC ELASTICITIES OF SOLIDS.
J.F.W.Bell.
Nature (London), Vol. 181, 1330 (May 10, 1958).

Measurements were made of the two velocities of so nd appropriate to longitudinal and torsional vibrations in a thin rod, the pulses being launched and received by coils on a magnetostrictive tube. Accurate values of Poisson's ratio are deduced, from the dynamic measurements and the known ratios of the specific heats, for Al, Cu, Pb and fused quartz. J.G.Oldroyd

539.32

4477. TEMPERATURE DEPENDENCE OF INTERNAL FRICTION IN GERMANIUM. P.D.Southgate.
Phys. Rev., Vol. 110, No. 4, 855-7 (May 15, 1958).

The internal friction of germanium was measured as a function of temperature at 100 kc/s. There is a peak at 420°C and little further rise to within a few degrees of the melting point. A specimen strained in tension shows a rapid rise with temperature above 500°C. These results are compared with those of Kessler (Abstr. 6718/1957) and it is suggested that the high-temperature rise found in all his specimens is due to thermal stressing. A small peak at 770°C is attributed to the presence of oxygen in the germanium. A.

539.37 : 539.4.011.25

4478. ON THE PROBLEM OF THE STATUS OF THE CONSTANTS OF PLASTICITY AND STRENGTH OF METALS. G.P.Zaĭtsev.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 2, 293-303 (1957).
In Russian.

A new theory of the mechanical properties of metals is proposed in which five constants of elasticity and plasticity normally required are replaced by only two. A.F.Brown

539.373

4479. ELECTRON MICROSCOPIC INVESTIGATION OF SLIP-LINE PRODUCTION ON COPPER SINGLE CRYSTALS. S.Mader.
Z. Phys., Vol. 149, No. 1, 73-102 (1957). In German.

The appearance of slip-lines, as shown by the electron microscope, is studied at various stages of deformation of Cu single crystals. With increasing distortion slip-lines lengthen, cross-slip is seen to appear, and the fragmentation of slip-bands is observed. The phenomena are shown to agree with theoretical ideas on the mechanism of deformation. J.Thewlis

539.373 : 548.578

ETCH FIGURES ON SLIP LINES IN SILVER CHLORIDE CRYSTALS. See Abstr. 3572

539.374

4480. AN INVESTIGATION OF THE RATE CONTROLLING MECHANISM FOR PLASTIC FLOW OF COPPER CRYSTALS AT 90° AND 170°K. H.Conrad.
Acta metallurgica, Vol. 6, No. 5, 339-50 (May, 1958).

The plastic-flow characteristics of copper single crystals at 90° and 170°K were investigated by means of incremental loading creep tests and change-in-strain-rate tension tests for the purpose of determining whether the intersection of dislocations is the rate-controlling process in low-temperature deformation. The present results indicate that although the nature of the stress function is similar to that predicted by the intersecting mechanism, i.e. strain rate = C exp B($\tau - \tau_G$), the constant B is relatively independent of temperature rather than proportional to the reciprocal of the temperature as required by the theory. This represents a serious objection to the theory. An analysis of the present data along with the data of previous investigators indicates some agreement with a rate-controlling mechanism based on the formation of thermal kinks in dislocations lying in close-packed directions. Several difficulties associated with the application of this mechanism to plastic flow are discussed. A.

539.374

4481. EFFECT OF WETTING OF AN IONIC CRYSTAL SURFACE ON THE CHOICE OF ONE OF THE EQUIVALENT SYSTEMS OF DODECAHEDRAL GLIDING DURING LINEAR DEFORMATION OF SPECIMENS. V.P.Bobrikov.
Zh. tekh. Fiz., Vol. 27, No. 4, 830-2 (1957). In Russian.

Experiments involving the stretching of NaCl and KCl crystals, both with and without mosaic structure, were carried out for the purpose of finding the site of the distribution of nuclei (micro-cracks) which determine the choice of the zone of gliding. Water was used for stimulating the supposed nuclei: paper strips wetted with water were applied to the chosen (two opposite) faces of the specimen, other faces being coated with vaselin oil; the crystals were then stretched continuously at a loading rate ≤ 3 g/mm^2 per sec. It was found that wetting determined unequivocally the activity of the zone of gliding according to the system (011), [011], always to the advantage of the zone whose axis was at right angles to the wetted face; water-stimulated shears developed, in turn, into single-zone gliding, and helped the same nuclei in dry faces to develop into cracks along the cleavage planes. F.Lachman

539.374 : 539.217

THE INFLUENCE OF PLASTIC DEFORMATION ON THE RATE OF DIFFUSION. See Abstr. 4460

539.378.3 : 518.5 : 532.72 : 681.142 : 621.317.79

ELECTRICAL ANALOGUE FOR TRANSIENT DIFFUSION AND FLOW. See Abstr. 3771

539.382 : 538.221

CALCULATED AND OBSERVED EFFECTS OF TEXTURE ON THE MAGNETIC PROPERTIES AND YOUNG'S MODULUS OF NICKEL SHEET. See Abstr. 4135

539.382.07

4482. TWO IMPROVED METHODS FOR DETERMINING YOUNG'S MODULUS. R.E.Green.
Amer. J. Phys., Vol. 26, No. 4, 258-9 (April, 1958).

Two methods are described for determining Young's modulus. The apparatus used in both cases utilizes a compensating device which eliminates the error caused by slippage or movement of the anchored end of the wire. The simplicity of the design of the apparatus is such that it may be constructed in any college laboratory. A.

539.4

4483. MECHANICAL STRENGTH OF ICE FROZEN FROM AN IMPURE MELT. E.R.Pounder.
Canad. J. Phys., Vol. 36, No. 3, 363-70 (March, 1958).

Ice frozen from a melt containing a small amount of a light alcohol, ketone, or ether is much weaker than normal ice, for a limited freezing exposure. The weakening effect is enhanced if the melt also contains traces of one or more of a variety of long-chain, organic substances, one of the most effective being sodium carboxymethyl cellulose. Inorganic salts, on the other hand, appear to be largely ineffective and may even cancel out the weakening action of the organic solvent. It is suggested that the organic additives are concentrated in the surface of the melt and remain as liquid layers between the ice crystals, thereby causing a large reduction in the shear strength of the ice sheet. Adsorption at the surface is discussed as a mechanism for concentrating organic substances in the surface layer and rejecting inorganic salts into the interior of the solution. A.

539.4.011.2

4484. THE CLEAVAGE OF METAL SINGLE CRYSTALS. A.N.Stroh.
Phil. Mag. (Eighth Ser.), Vol. 3, 597-606 (June, 1958).

A model of cleavage applicable to metals cleaving on the slip plane is developed in which a crack is initiated at the end of a low-angle tilt boundary terminating inside the crystal. The strength of the metal is determined by the difficulty of growth of the crack. Satisfactory agreement is obtained with the experimental results for zinc. A.

539.4.016

4485. ON THE MECHANISM OF WORK HARDENING IN FACE-CENTRED CUBIC METALS, WITH SPECIAL REFERENCE TO POLYCRYSTALLINE COPPER. P.Feltham and J.D.Meakin.
Phil. Mag. (Eighth Ser.), Vol. 2, 105-12 (Jan., 1957).

Tensile specimens of oxygen-free polycrystalline copper (99.991%) were annealed for various periods in vacuo, in the range from 500° to 700° C, to obtain variations in the grain sizes and yield points. The initial rate of work-hardening of all specimens was linear up to strains of about 1.5%, and independent of the magnitude of the yield stress. This hardening appeared to be of the type responsible for the linear hardening which follows easy-glide in single crystals, the theory of which was recently developed by Friedel. At higher strains parabolic hardening occurred. In this stage the coefficient of work hardening χ_p (defined as the ratio $d\sigma^2/d\epsilon$, where σ and ϵ are the tensile stress and strain respectively) was found to obey the relation $\chi_p \cong G\sigma_Y/\pi$, i.e. it was proportional to the product of the shear modulus G, and the tensile yield stress σ_Y. This equation is derivable from Mott's theory, in which parabolic hardening is regarded as resulting from the action of the long-range stress fields of piled-up dislocation arrays on Frank–Read sources in the grains. (See also following abstract.) A.

539.4.016

4486. ON THE MECHANISM OF WORK HARDENING IN FACE-CENTRED CUBIC METALS WITH SPECIAL REFERENCE TO POLYCRYSTALLINE COPPER. II. P.Feltham and J.D.Meakin.
Phil. Mag. (Eighth Ser.), Vol. 2, 1237-45 (Oct., 1957).

Rods of annealed polycrystalline copper (99.991%) were deformed in tension at 77, 195 and 293° K. The initial mode of hardening was linear up to a temperature-depended tensile stress σ_c; the mechanism was the same as the one leading to linear hardening (stage II) in single crystals. The assumption that at stresses above σ_c "yielding" took place by the spread of slip from some of the small slip zones characteristic of the linear stage, and that this resulted in interaction hardening, is shown to account satisfactorily for the parabolic shape of the stress–strain curves above σ_c. A.

539.4.016 : 539.431

4487. SMALL ANGLE SCATTERING FROM COLD-WORKED AND FATIGUED METALS. H.H.Atkinson.
Phil. Mag. (Eighth Ser.), Vol. 3, 476-88 (May, 1958).

Experiments have been made on the small-angle scattering of X-rays from polycrystalline copper and single grains of aluminium deformed by cold work or fatigued by pulsating tension. The results confirm in a direct and conclusive way that almost all of the scattering is due to double Bragg reflections as proposed by Beeman et al. (Handbuch der Physik, Vol. 32, 440, 1957). No surface scattering has been observed. Double Bragg reflections have been eliminated in small-angle scattering experiments using cold neutrons: the results indicate the magnitude of the scattering from defects in the volume of the metal. The magnitude of the effect is consistent with scattering from dislocations. There was no observable effect from fatigued metals. Hence there is no direct evidence for the existence of cavities in metals as a result of small-angle scattering experiments with either X-rays or neutrons. A.

539.42 : 539.2

4488. THE INFLUENCE OF IMPERFECTIONS ON THE STRENGTH OF ICE. H.H.G.Jellinek.
Proc. Phys. Soc., Vol. 71, Pt 5, 797-814 (May, 1958).

Tensile strength measurements on ice cylinders adhering to stainless steel have been made as a function of rate of loading, thickness and cross-sectional area of specimens, and temperature. A rapid increase of tensile strength occurs as the volume is decreased. The data for a temperature of −4.5° C can be represented

over a thousandfold range of volumes by an equation as follows

$$S = 2.74AV^{-0.84} + 9.4 \text{ kg/cm}^2$$

where S is the tensile strength, A the cross-sectional area in cm^2 and V the volume in cm^3. The experimental results are interpreted by means of a statistical treatment involving imperfections in the specimens. The statistics for a model consisting of a large number of parallel elements is elaborated. The final equation derived on statistical grounds approximates the equation found empirically, and reads as follows

$$\bar{S}_{r,n} = kA^{1/\beta}V^{-1/\beta} + C$$

where $\bar{S}_{r,n}$ is the number average of the tensile strength, k, β and C are constants and r is the number of imperfections in each of n parallel elements. This result is quite general and not confined to ice. The conclusion is reached that due to imperfections the tensile strength is a statistical function of the volume and cross-sectional area of the specimens. Superimposed on the statistical effect is a stress distribution effect, which becomes predominant for large volumes. A.

539.434

4489. AN INVESTIGATION OF THE DEFORMATION OF METALS UNDER SMALL STRESSES. I. SOME REGULARITIES OF THE CREEP OF COPPER AND ALUMINIUM.
B.Ya.Yampol'skii and T.A.Amfiteatrova.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 1, 131-40 (1957).
In Russian.

Experiments are described by which the parameters required in the creep theory of Likhtman (Dokl. Akad. Nauk SSSR, Vol. 72, 1079, 1950) are obtained. These parameters are tabulated together with their variation with temperature and grain size for polycrystals of copper and aluminium. A.F.Brown

539.501

4490. THE RHEOLOGY OF SOME TWO-DIMENSIONAL DISPERSE SYSTEMS. J.G.Oldroyd.
Proc. Cambridge Phil. Soc., Vol. 53, Pt 2, 514-24 (April, 1957).

An investigation is made of the deformation and flow properties of two-dimensional disperse systems consisting of small circular patches of one component widely dispersed in a continuous component with different rheological properties. Attention is restricted to small deformations (or small rates of deformation in the case of a fluid system) so that the equations of state are linear and the properties of each component can be characterized by two elastic moduli, or by two operators involving d/dt which take the place of moduli. Surface tension in each component and boundary tension between the components are taken into account, so that the theory can be applied to interfacial films at liquid–liquid or liquid–gas interfaces as well as to thicker sheets and films. General formulae are derived, expressing the two modulus operators of a disperse system in terms of those of the components, and their use is illustrated by means of examples. A.

539.56

4491. ON THE PROBLEM OF THE BRITTLENESS OF METAL-LIKE COMPOUNDS. V.S.Neshpor and G.V.Samsonov.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 1. 181-3 (1957).
In Russian.

The metal-like compounds (compounds of transition metals with light metalloids e.g. WC, TiN) are arranged in the order of increasing brittleness. This order is the same as that obtained if the same materials are arranged in increasing order of strength of interatomic binding (as measured by root-mean-square thermal displacement of atoms obtained from X-ray data). Hence brittleness can be reduced by choosing the alloying metalloid which gives weakest interatomic forces. A.F.Brown

539.576

4492. SURVEY OF POSSIBLE WEAR MECHANISMS.
J.T.Burwell,Jr.
Wear, Vol. 1, No. 2, 119-41 (Oct., 1957).

The four principal types of mechanical wear, namely, adhesive, abrasive, corrosive and surface fatigue, as well as several minor types are described. Quantitative equations are derived in three cases relating the amount of wear material removed from the surfaces of their useful life to operating conditions such as distance of travel, speed, applied load and mechanical properties of the surface. These equations are compared with experiment, where such exists, and agreement is found in general to be good over certain ranges although more carefully controlled experiments are needed. Hence the relations may be used by the designer and engineer in designing and constructing equipment having moving parts in which wear will be encountered. A.

539.576

4493. THE MECHANICAL WEAR OF METALS. W.Hirst.
Brit. J. appl. Phys., Vol. 9, No. 4, 125-32 (April, 1958).

The design of fundamental experiments for examining the wear phenomena encountered in the conditions of speed and loading of industrial machines is discussed. Apparatus is described in which nominal point or nominal line contact can be maintained indefinitely, and some of the phenomena observed when a lubricant is used are discussed. With carefully run-in specimens, the hydrodynamic condition of lubrication is maintained up to very heavy loads; a method of measuring the thickness of the oil film in line contact conditions is outlined and some results given. In unlubricated conditions the phenomena of wear can be studied using simpler equipment. The main phenomena, the laws and the mechanisms of wear in unlubricated conditions are discussed, and the present state of development of theories of wear is outlined. In conclusion, some suggestions are made about the directions in which fundamental studies of wear need to be pursued. A.

539.576 : 537.533.2

EXO-ELECTRON EMISSION OF ABRADED METALS. See Abstr. 4063

539.61

4494. A NOTE ON THE ADHESION OF ELASTIC SOLIDS.
K.L.Johnson.
Brit. J. appl. Phys., Vol. 9, No. 5, 199-200 (May, 1958).

A theoretical analysis is made of the stresses acting at the contact surface of two elastic spheres which are assumed to adhere to each other after the force pressing them together has been removed. The stress at the periphery of the contact area is shown to be tensile and infinite, so that adhesion is physically impossible; the spheres would peel apart. The theoretical results are consistent with the experimental work of Bowden and Tabor. A.

539.61 : 539.621

4495. THE ADHESION AND STRENGTH PROPERTIES OF ICE.
L.E.Raraty and D.Tabor.
Proc. Roy. Soc. A, Vol. 245, No. 1241, 184-201 (1958).

This paper describes a study of the adhesion of ice to various solids. If water is frozen on to a clean metal surface the interface is stronger than the ice and fracture occurs within the ice itself. The detailed behaviour depends on the stresses developed near the interface. If tensile stresses are high the failure is brittle and the breaking stress is temperature independent. If the tensile stresses are below a critical limit the failure is ductile, and the breaking stress increases linearly as the temperature is reduced below $0^{\circ}C$. Ductile failure appears to be determined by the onset of a critical creep rate and the variation of breaking stress with temperature may be explained in this way. This view is supported by the observation that small quantities of dissolved salts which increase the creep rate of ice produce a parallel reduction in the adhesive strength. Surface contaminants on metals reduce the adhesion by a very large factor and it is suggested that this is due primarily to a reduction in the area over which strong metal/ice adhesion occurs. The adhesion of ice to polymeric materials differs from the adhesion to metals. The interfacial strength appears to be less than the strength of ice and failure occurs truly at the interface. Friction experiments carried out with clean and lubricated metals and polymers sliding on ice provide a measure of the shear strength of the solid/ice interface. The results show a marked parallelism with those obtained in the adhesion experiments; this again emphasizes the close connection between the friction and adhesion of solids. This study has some bearing on the de-icing of aircraft and of ships sailing in polar seas. The results suggest that ice layers may be removed most readily if brittle fracture can be achieved. Constraint of the ice inhibits brittle fracture and the forces to produce ductile failure are considerably greater. These forces may, however, be reduced by adding small quantities of suitable salts, since these reduce the resistance to ductile flow if the system is above the eutectic temperature. Finally, hydrophobic materials show a very low adhesion; this is particularly marked in the adhesion of ice to polytetrafluoroethylene. A.

539.62 : 539.576

4496. FRICTION AND WEAR UNDER BOUNDARY LUBRICATION. A SUGGESTION. B.Lunn.
Wear, Vol. 1, No. 1, 25-31 (Aug., 1957).

A simplified suggestion concerning the relation between friction and wear under boundary conditions is proposed. It is based on a hypothesis, previously published by the author, in which it was suggested that the boundary film is a plastic solid. In order to simplify matters it is presumed that the film is a homogeneous

plastic solid, with a plastic flow proportional to the shear strength of the solid. It is further supposed that the plastic flow of the boundary film permits the use of simplified hydrodynamic equations. With these simplifications it is possible to construct a simple diagram showing the frictional behaviour under boundary conditions. The diagran shows, as expected, that under predominantly dry boundary conditions a decrease in the coefficient of friction leads to reduced wear. In contrast, at predominantly lubricated boundary conditions wear will increase with decreasing coefficient of friction. This is actually in accordance with the technical observations. Further, the diagram developed gives a possibility of understanding "the speed effect" in cold rolling. Even if the presuppositions are rather simplified, the diagram developed corresponds well with technical experience. A.

539.62

4497. ON KINETIC FRICTION BETWEEN UNLUBRICATED METALLIC SURFACES. F.F.Ling and E.Saibel.
Wear, Vol. 1, No. 3, 167-72 (Dec., 1957).

A theory of friction between unlubricated metallic surfaces in sliding contact is proposed. For sliding conditions for which "hot" or "cold" welding of asperities is possible, the present weld-junction theory leads to a simple formulation of the coefficient of friction under idealized conditions. This result differs from that of Bowden and Tabor (see Abstr. 3044/1952) in that the coefficient of friction is found as the ratio of the shear strength to the yield pressure multiplied by a factor in which additional effects of load, relative velocity, temperature, and other physical properties appear. In arriving at this factor, the process of welding and fracturing of surface asperities is postulated to be a unimolecular reaction. A.

539.62

4498. THE MECHANISM OF BOUNDARY LUBRICATION AND THE PROPERTIES OF THE LUBRICATING FILM. SHORT- AND LONG-RANGE ACTION IN THE THEORY OF BOUNDARY LUBRICATION.
B.V.Deryaguin, V.V.Karassev, N.N.Zakhavaeva and V.P.Lazarev.
Wear, Vol. 1, No. 4, 277-90 (Feb., 1958).

Two versions of the blow-off method are described, by means of which the dependence of the viscosity of oils and other non-volatile fluids on the distance from the solid wall can be measured, and the viscosity localized with an accuracy of 10 A. In the case of non-polar specially purified vaseline oil the viscosity remains strictly constant to a distance of the order of 10^{-7} cm from the wall. The addition of polar additives causes changes in the viscosity near the wall. In a number of cases the viscosity changes discontinuously at some distances of the order of 10^{-6} to 10^{-5} cm from the wall. In the case of polar liquids the viscosity may rise or fall on approaching the wall, depending on the molecular structure. The results obtained prove that the solid wall is capable of altering the orientation of the molecules in adjacent layers of the liquid up to 10^{-5} cm thick, and even up to 10^{-3} cm thick in the case of polymeric liquids. This effect plays a substantial part in the mechanism of boundary lubrication, since oiliness always disappears if it is absent. In conclusion, an examination is made of the mechanical properties of the boundary lubrication layer which explain both the existence of static friction and the observation of the two-term friction law derived by Deryaguin from the molecular theory of friction. The general conclusion is the impossibility of accounting for the phenomenon of boundary lubrication without taking into consideration the specific properties of the polymolecular boundary layers of liquids. A.

539.621

4499. PRESSURE DISTRIBUTIONS BENEATH SPHERICAL AND CONICAL SHAPES PRESSED INTO A RUBBER PLANE, AND THEIR BEARING ON COEFFICIENTS OF FRICTION UNDER WET CONDITIONS. B.E.Sabey.
Proc. Phys. Soc., Vol. 71, Pt 6, 979-88 (June, 1958).

Investigations have shown that a high skidding resistance on wet roads is associated with the presence of sharp edges in the road surface: on these sharp edges high pressures are set up which assist in breaking through the lubricating water film between tyre and road. This paper gives some details of laboratory tests made to investigate the dependence of skidding resistance on such localized pressures. A.

539.621

4500. THE FRICTION OF HARD SLIDERS ON LUBRICATED RUBBER: THE IMPORTANCE OF DEFORMATION LOSSES.
J.A.Greenwood and D.Tabor.
Proc. Phys. Soc., Vol. 71, Pt 6, 989-1001 (June, 1958).

A study was made of the friction of hard spheres and cones on a well-lubricated rubber surface under conditions where relatively large deformations are produced. It is found that with spheres the sliding friction is almost the same as the rolling friction. Earlier work has shown that in the latter case the friction arises primarily from hysteresis losses in the rubber and it is concluded that, under the experimental conditions described, the main source of friction in lubricated sliding arises from the same cause. With conical sliders it is not possible to make a direct comparison with rolling experiments, but a simple calculation suggests that here again the friction is largely due to deformation losses in the rubber. For cones of small semi-angle there is a large increase in friction but this is associated with penetration of the lubricant film and tearing of the rubber. The friction results are in close agreement with measurements described by Sabey (see preceding abstract) for spheres and cones sliding on wet rubber at relatively high speeds (about 6 ft/sec). This suggests that in Sabey's experiments the water film provides very effective lubrication and that the friction arises largely from hysteresis losses in the rubber itself. As a general conclusion this study of the friction of lubricated rubber suggests that where interfacial adhesion is small and where relatively large local deformations occur the friction may well be dominated by deformation losses in the rubber. Under these conditions we may therefore expect the friction of hard spherical or conical sliders on rubber to be greater for rubbers of low Young's modulus and high hysteresis losses. A.

PHYSICAL CHEMISTRY

541.1 : 66.0

4501. PHYSICAL METHODS OF INVESTIGATING CHEMICAL PROBLEMS. R.J.Taylor.
Brit. J. appl. Phys., Vol. 9, No. 5, 165-72 (May, 1958).

A brief review of physical techniques in current use is given, together with a detailed illustrative study of two problems: the removal of fishy flavour from vitamin A oils, and the relationship of polymorphic form to the characteristics of glyceride oils. The study is treated discursively to bring in matters of related interest. A.

541.1

4502. BIBLIOGRAPHY OF RESEARCH ON DEUTERIUM AND TRITIUM COMPOUNDS. 1953 AND 1954.
V.R.Johnson, L.M.Brown and A.S.Friedman.
Circ. Nat. Bur. Stand., No. 562 (Suppl. 1), 31 pp. (1957).

A bibliography of 720 references to published research on the properties of deuterium and tritium compounds is given. The subject matter of each entry is indicated by letter codes related to a list of broad subject headings. An index of deuterium and tritium compounds and a subject index are included. A.

PHASE EQUILIBRIUM. CHEMICAL REACTIONS

541.12

4503. CHEMICAL EQUILIBRIUM IN COMPLEX MIXTURES.
W.B.White, S.M.Johnson and G.B.Dantzig.
J. chem. Phys., Vol. 28, No. 5, 751-5 (May, 1958).

A new method for the determination of the equilibrium composition of complex mixtures is described. The general method, which is based on the minimization of free energy, states the problem with unusual simplicity, avoiding many of the usual difficulties of description and computation. Two specific computation procedures are shown, one using a steepest descent technique applied to a quadratic fit, the other making use of linear programming. A.

541.124

4504. PYROLYSIS OF MERCURY DIMETHYL VAPOR.
R.Srinivasan.
J. chem. Phys., Vol. 28, No. 5, 895-8 (May, 1958).

A comparison of the published experimental results from three ources on the pyrolysis of mercury dimethyl vapor in a static ystem at about 615° K indicates that there is disagreement in the ate data although the nature of the decomposition is similar in all ases. Additional data are given to show that this discrepancy is resumably due to surface effects. The nature of the decomposition roducts is markedly different in the published studies of the pyroly- is in a flow system at about 800° K. In this instance, surface ffects appear to be unimportant. It is suggested that the hetero- eneous reactions: $CH_3HgCH_3 \rightarrow CH_3$ + product(s) followed by poly- ierization of the products to $(CH_2)_n$ + Hg constitute the difference n mechanism between the two systems. The evidence for this roposal is examined. Some minor reactions of the methyl radical this system are discussed on the basis of entropy changes in ese reactions. A.

ELECTROCHEMISTRY

541.133 : 537.311.33

RECTIFICATION BETWEEN GERMANIUM AND AN LECTROLYTE. See Abstr. 4015

541.135 : 534.39

505. SOME OBSERVATIONS ON THE DEBYE EFFECT IN LECTROLYTES. A.N.Hunter.
roc. Phys. Soc., Vol. 71, Pt 5, 847-51 (May, 1958).

The Debye effect (existence of an electric potential wave ccompanying the passage of an acoustic wave through an electro- yte) in water is found to be comparable in magnitude with that iven by Debye's formula for solutions of simple salts. The effect oes not occur with the non-polar liquid benzene and is unaltered by latinizing the electrodes. A general description of the apparatus s given. W.Good

541.135 : 532.77

NEIGHBOUR INTERACTIONS AND SYMMETRIC PROPERTIES POLYELECTROLYTES. See Abstr. 3774

541.135.5

506. ADIABATIC RATE PROCESSES AT ELECTRODES. ENERGY—CHARGE RELATIONSHIPS. N.S.Hush.
chem. Phys., Vol. 28, No. 5, 962-72 (May, 1958).

The distinction between adiabatic and nonadiabatic reaction echanisms at an electrode/solution interface is emphasized; in eneral, only adiabatic or near-adiabatic paths are important in ermally activated reactions. The role of the dielectric in deter- ining the course of such reactions is discussed. A general inter- retation of the transfer coefficient and an account of the activation rocess in simple systems are given in terms of the distribution of lectron charge density in the transition state; these are shown to be good accord with experiment. The conventional approach to these roblems, in which an approximate potential-energy path for the re- ction is calculated from intersecting potential-energy curves for he initial and final states of the system, is criticized, and an altern- tive representation in terms of charge variation is proposed. A.

PHOTOCHEMISTRY. RADIATION CHEMISTRY

541.15 : 539.17

507. THE CHEMICAL EFFECTS OF RADIATIVE THERMAL EUTRON CAPTURE. IV. THE KINETICS OF A RADIAL ECOMBINATION PROCESS IN SOLIDS.
M.de Maine, A.G.Maddock and K.Taūgbōl.
isc. Faraday Soc., No. 23, 211-19 (1957).

The kinetics of the slower state of the recombination of the agments produced by neutron capture in potassium chromate were tudied. The results indicate a surprisingly small activation energy r the process. The earlier states of the process were studied in olid solutions of potassium chromate in potassium fluoberyllate, nd in an entirely different type of compound, hexabromo-ethane. both cases the essential features of the recombination resemble ose in potassium chromate, but the recombination can be studied much lower temperatures in hexabromo-ethane. The results are scussed in terms of a mechanism suggested in a previous paper bstr. 831/1957). A.

541.15

4508. GRAFT COPOLYMERS — A NEW TECHNOLOGY?
D.J.Metz.
Nucleonics, Vol. 16, No. 4, 73-7 (April, 1958).

Free radicals formed by irradiating organic polymers may result in cross-linking or, if another monomer is present, in the formation of graft polymers. These combine some of the properties of both parent polymers and have many useful applications, such as the construction of better ion-exchange membranes. R.D.Smith

DISPERSIONS. COLLOIDS. ADSORPTION

541.183

4509. INVESTIGATION OF THE ADSORPTION OF ANIONS ON METAL SURFACES USING RADIOACTIVE INDICATORS.
K.Schwabe, K.Wagner and C.Weiszmantel.
Z. phys. Chem. (Leipzig), Vol. 206, No. 5-6, 309-20 (April, 1957). In German.

The adsorption of cyanide and of iodide ions on platinum, nickel and silver foil was measured with C^{14} and I^{131}. The cyanide ions form a strongly bound monolayer, the iodide ions a less strongly bound one, and with nickel and silver the iodide reacts chemically after sorption. The cyanide ions can displace the iodide ions from the adsorbed layer. S.J.Gregg

541.183.022

4510. TRANSITIONS IN ADSORBED MONOLAYERS.
I. EXPERIMENTAL. B.B.Fisher and W.G.McMillan.
J. chem. Phys., Vol. 28, No. 4, 549-54 (April, 1958).

Describes the preparation of sodium bromide samples on which adsorbed krypton and methane exhibit transitions in the region below one monolayer. The isotherms for these gases are reported for temperatures ranging from 64 to 85° K. The nitrogen isotherms at various temperatures show no such transition, and are discussed from the point of view of the B.E.T. theory. A device for maintaining a constant level of liquid nitrogen under reduced pressure is also described. A.

541.183.022

4511. TRANSITIONS IN ADSORBED MONOLAYERS.
II. THEORETICAL. B.B.Fisher and W.G.McMillan.
J. chem. Phys., Vol. 28, No. 4, 555-61 (April, 1958).

The grand partition function is employed to derive the isotherm and the two-dimensional equation of state corresponding to a model of localized monolayer adsorption similar to that of Rushbrooke, in which the lateral vibrational partition function is permitted to depend on the occupation number of neighbouring sites. This treatment includes the Fowler "crude" isotherm as a special case. As a competing theory, a parallel development is given for the van der Waals model of mobile adsorption. Equations are presented for the critical parameters, and for the determination of the coexistence curves for these models. Finally, graphical comparisons are made which demonstrate the experimental distinguishability of the three theories on plots which rectilinearize one at a time. A.

541.183.022

4512. TRANSITIONS IN ADSORBED MONOLAYERS.
III. RESULTS AND COMPARISONS. B.B.Fisher and W.G.McMillan.
J. chem. Phys., Vol. 28, No. 4, 562-71 (April, 1958).

The experimental and theoretical results of Pt I and II are combined to yield "experimental" values of the adsorption parameters for nitrogen, krypton and methane on sodium bromide. These are compared with the results of extensive theoretical calculations of the adsorption energy χ, the lateral interaction energy ω and the frequencies of various vibrational modes. Of the several parameters, the agreement between theory and experiment is best for χ; of the several gases, the agreement is best for krypton. An appendix gives fitted functions for inverse sixth power lattice sums, and for the electric field strength above the 100 surface of a f.c.c. ionic lattice. A.

541.183.2 : 539.234 : 537.311.3

NITROGEN ADSORPTION ON EVAPORATED Ba FILMS. See Abstr. 3983

CHEMICAL STRUCTURE

541.57 : 538.224

DIAMAGNETISM AND HYDROGEN BOND. See Abstr. 4141

542.923 : 537.534.3

4513. THE THERMAL DECOMPOSITION OF POLYVINYL ALCOHOL USING MASS SPECTROMETER.
H.Futama and H.Tanaka.
J. Phys. Soc. Japan, Vol. 12, No. 4, 433 (April, 1957).

545 : 535.43

4514. AN INSTRUMENT FOR THE DETERMINATION OF POTASSIUM IN SODIUM CHLORIDE. G.H.Laycock.
J. sci. Instrum., Vol. 35, No. 5, 171-3 (May, 1958).

An instrument was designed to measure the percentage of potassium in a 2.4 g sample of NaCl crystals in the range from 0 to 4% with an accuracy of ±5%. A determination, which takes 1 min, is made by recording photoelectrically the light scattered by suspended particles of potassium cobaltinitrite obtained by the addition of sodium cobaltinitrite solution to the dissolved sample. The instrument, which includes a novel device for dispensing a fixed quantity of reagent, can be used to determine the percentage of other impurities in other substances by selecting suitable reagents. A.

CHEMICAL ANALYSIS

545.1 : 531.752

4515. CONTINUOUS-RECORDING LABORATORY THERMO-BALANCE. E.S.Bartlett and D.N.Williams.
Rev. sci. Instrum., Vol. 28, No. 11, 919-20 (Nov., 1957).

Sensitivity and accuracy of the instrument permitted transcription of weight-change rates from 3 to 70 mg/min. Suggestions for instrument design for measurement of oxidation rates in the order of 0.1 mg/hr are presented. A.

545.824 : 539.262

ELECTRON PROBE X-RAY MICROANALYSER. See Abstr. 4466

CRYSTALLOGRAPHY

548.1 : 512.9

4516. MATTER TENSORS IN THE CRYSTALLOGRAPHIC GROUPS OF CARTESIAN SYMMETRY. R.Fieschi.
Physica, Vol. 23, No. 10, 972-6 (Oct., 1957).

See Abstr. 3999 (1952), 530 (1953), 2852 (1954). The direct inspection method is used to construct a table of tensor components for second-, third-, and fourth-order tensors in the symmetry groups other than hexagonal and rhombohedral. A.R.Stokes

548.24

4517. ON THE MECHANISM OF DEFORMATION TWIN IN F.C.C. CRYSTAL. A.Ookawa.
J. Phys. Soc. Japan, Vol. 12, No. 7, 825 (July, 1957).

A mechanism is proposed to explain the formation of a twin observed in a copper crystal cold worked at 4.2°K. J.Adam

548.25 : 539.217

INFLUENCE OF ORIENTATION OF NEIGHBOURING CRYSTALLITES ON INTERCRYSTALLINE DIFFUSION. See Abstr. 4456-7

548.4 : 537.226.2

4518. SOME ASPECTS OF WEDGE-SHAPED DOMAINS IN $BaTiO_3$ CRYSTAL. T.Nakamura, W.Kinase and Y.Kato.
J. Phys. Soc. Japan, Vol. 12, No. 7, 836-7 (July, 1957).

The observed pattern is explained in terms of parallel strips of c and a domains. This is consistent with the curved form of the crystal plate. After cooling to 0°C, when a more complex pattern appeared, the crystal did not regain the original pattern or curvature on returning to room temperature. K.W.Plessner

548.5

4519. X-RAY INVESTIGATION OF PERFECTION IN TIN WHISKERS. H.G.Smith and R.E.Rundle.
J. appl. Phys., Vol. 29, No. 4, 679-83 (April, 1958).

Tin whiskers with elasticities far above that of bulk tin were examined for perfection by X-ray diffraction. Intensities were measured for several whiskers varying in diameter from 2 μ to 11 μ. Some of the data were obtained by means of a Geiger counter with Cu Kα radiation and some by photographic methods with Mo Kα radiation. The observed structure factors were corrected for extinction according to the dynamical theory of X-ray diffraction with the crystallite size as a parameter and then compared to the calculated structure factors. The agreement with dynamical theory for imperfect crystals is very good, yielding a crystallite size of 1.5 μ for a 5.5 μ whisker and 2.7 μ for whiskers of about 10 μ in diameter. The whiskers were observed growing in several crystallographic directions. A.

548.5 : 537.533.2

4520. FIELD EMISSION FROM MERCURY WHISKERS.
R.Gomer.
J. chem. Phys., Vol. 28, No. 3, 457-64 (March, 1958).

A method for growing metal whiskers in a modified field emission tube was developed and applied to Hg. Emission patterns from whiskers show these to be 110 oriented single crystals when grown on a tungsten substrate. Their strength, estimated from the electric field necessary for emission, is ~ 10^{10} dyn/cm^2. An electrical method of following length, based on the relation between this quantity and the surface field was used to elucidate whisker growth kinetics. It is found that growth is positively exponential, indicating that it occurs by diffusion of impinging atoms to the growing end, where incorporation occurs. From the length where exponential growth ceases it is possible to find a limit for the diffusion coefficient of Hg on Hg and to estimate the activation energy of the surface diffusion as ~ 1.1 kcal. Elastic twisting under tensile stress is sometimes found and ascribed to the presence of screw dislocations. Possible applications of the technique are pointed out. A.

548.52

4521. ON WHISKER GROWTH SHAPES. S.Amelinckx.
Phil. Mag. (Eighth Ser.), Vol. 3, 425-8 (May, 1958).

A two-dimensional model is used to illustrate how kinks can occur in whiskers growing at the tip, containing a mobile screw dislocation. In the three-dimensional case, climb is involved, which causes the dislocation to become helical and results in a coiled crystal. J.Franks

548.52

4522. THE PREPARATION OF LARGE ZINC MONOCRYSTALS WITH PREDETERMINED ORIENTATION. B.N.Bushmanov.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 2, 310-14 (1957).
In Russian.

Zinc is maintained at about 50°C above its melting point in an electrically heated crucible, the metal surface being protected by a thick layer of $ZnCl_2$ flux. Through the flux a pointed single crystalline rod of zinc is passed, the upper end of which is water-cooled. By suitable adjustment of the heating current to the crucible, a single crystal can be made to grow from the seed rod. The orientation and angle of entry of the seed control the orientation of the final crystal. The method is specially suited to the preparation of single crystals of odd (e.g. pear) shapes and of mass up to 2 kg. A.F.Brown

548.522

4523. INFLUENCE OF ORGANIC VAPOURS ON THE CRYSTAL HABIT OF ICE. J.Hallett and B.J.Mason.
Nature (London), Vol. 181, 467-9 (Feb. 15, 1958).

The effects of small concentrations of iso-butyl alcohol vapour on the growth of ice crystals from water vapour at about −15°C are described. The usual dendritic growth is replaced either by plate-like growth or by hollow prisms. See Abstr. 4173 (1955). A.R.Stokes

548.522

4524. GROWTH AND EVAPORATION OF CRYSTALS FROM THE VAPOUR PHASE. S.A.Kitchener and R.F.Strickland-Constable.
Proc. Roy. Soc. A, Vol. 245, 93-111 (May 6, 1958).

The rates of growth and evaporation of single-crystal faces of benzophenone [110], benzophenone [111], polycrystalline benzophenone and rhombic sulphur [111] were measured by means of a torsion balance technique. The method aims at providing correct information concerning the temperature of the crystal face and the pressure of vapour in contact with the face; special attention was directed to reducing the partial air pressure to a point at which diffusional resistance becomes negligible. Growth and evaporation curves were in each case obtained over a range of supersaturations, and for several temperatures. At high supersaturations the curves of growth and evaporation as a function of supersaturation are straight lines: at lower supersaturations both growth and evaporation lines become slightly curved in the sense tending to reduce the slope as the curves pass through the origin. At high supersaturations values of α, the condensation coefficient, are obtained which in all cases lie between 0.1 and unity. The question whether the shape of the curves can be explained in terms of Frank's theory of crystal growth is discussed. A short discussion is also given of the theory of momentum transfer to the surface for the case where the probability of adsorption is a function of the velocity of approach of the molecule. A.

548.526

4525. REGULARITIES IN THE PRODUCTION OF SINGLE CRYSTALS OF ZINC BY THE METHOD OF ZONE CRYSTALLIZATION.
V.N.Rozhanskii, N.V.Dekartova and I.A.Bakeeva.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 3, 527-30 (1957).
In Russian.

The orientations of Zn single crystals, grown by the travelling furnace method, were correlated with the rate of furnace travel. The most probable orientation was determined by a relationship between the rate of growth of a given face and the rate of furnace travel. When the furnace travelled much slower than the growth rate of any face, the orientations of the single crystals obtained were randomly distributed. A.F.Brown

548.57

4526. SYMMETRY OF SNOW CRYSTALS. S.Tolansky.
Nature (London), Vol. 181, 256-7 (Jan. 25, 1958).

It is suggested that the remarkable symmetry occasionally shown by well-developed snow crystals can be explained by postulating that a snow crystal behaves as a mechanical vibrating plate (Chladni plate). Such a plate will vibrate with hexagonal symmetry and show a complex distribution of nodes and antinodes. It is conjectured that growth will take place more easily at nodal regions. Conversely, where growth takes place a mechanical damping results, and this is felt simultaneously in the other arms, hence a symmetrical growth pattern evolves. S.Tolansky

548.574

4527. DISLOCATION ETCH PIT FORMATION IN LITHIUM FLUORIDE. J.J.Gilman, W.G.Johnston and G.W.Sears.
J. appl. Phys., Vol. 29, No. 5, 747-54 (May, 1958).

Dislocation etch pits can be formed on LiF by a dilute aqueous solution of FeF_3. The etch pit formation is described in detail, and the mechanism for pit formation is discussed. The nature of the etch pits depends on the character of the dislocation, and on the exact composition of the etchant. Edge dislocations and screw dislocations etch slightly differently; the former produce deeper pits. The etching is inhibited by some segregated impurities at dislocations, therefore aged dislocations and fresh dislocations etch much differently. Etch pit formation is probably due to the preferential nucleation of unit pits one molecule deep at a dislocation, and the movement of the monomolecular steps across the surface. The relative rates of these two processes determine the shape of the etch pits. The nucleation rate for unit pits depends upon the dislocation energy, hence upon the character of the dislocation and the impurity content as suggested by Cabrera. The nucleation rate is faster at edge dislocations, because of their higher energy. The nucleate rate is low at dislocations with segregated impurities, because the impurities lower the dislocation energy. The ferric ion is adsorbed on the surface and inhibits the motion of steps, so that steeper, more visible pits are produced as the iron content is increased. A.

X-RAY CRYSTALLOGRAPHY

548.73/.74

X-RAY AND ELECTRON INVESTIGATION OF MATERIALS. See also under "Structure of solids". Decimal classification 539.26/.27

548.733

4528. A COUNTER-TUBE INSTRUMENT FOR RECORDING X-RAY DIFFRACTION DIAGRAMS. G.Becherer and G.Lennig.
Exper. Tech. der Phys., Vol. 5, No. 5, 206-17 (1957). In German.

The general layout is described, and tables of errors of observation are given. Examples of applications to X-ray scattering by glass and to powder diagrams are given. A.R.Stokes

548.734 : 536.413

X-RAY DETERMINATION OF THE THERMAL EXPANSION OF SINGLE CRYSTALS. See Abstr. 3930

548.734

4529. IMPROVED RESOLUTION OF X-RAY DIFFRACTION PATTERNS OF PROTEIN CRYSTALS AT LOW TEMPERATURE. M.V.King.
Nature (London), Vol. 181, 263-4 (Jan. 25, 1958).

Crystals of ribonuclease II grown from solution in 55% 2-methyl-2,4-pentanediol were photographed at room temperature and at -27°C, and a 15% decrease in the minimum observable spacing was found at the lower temperature. The solvent does not crystallize at low temperatures. A.R.Stokes

548.734.3

4530. A METHOD OF PREPARING AND FILLING PLASTIC TUBES FOR SPECIMENS FOR X-RAY POWDER PHOTOGRAPHS. W.E.Armstrong and R.J.Davis.
J. sci. Instrum., Vol. 35, No. 1, 36-7 (Jan., 1958).

A thin-walled plastic tube is formed on the end of a wider glass tube, which can be used as a filling funnel. A.R.Stokes

548.735.4

4531. THE LATTICE CONSTANT OF PURE METALLIC VANADIUM AND THE INFLUENCE OF OXYGEN ON CHANGE OF THIS CONSTANT. M.A.Gurevich and B.F.Ormont.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 1, 112-14 (1957).
In Russian.

Published data for the lattice constant (a) of vanadium are reviewed and compared with new measurements. It is concluded that for spectroscopically pure malleable vanadium a = 3.024 ± 0.001 A (3.018 ± 0.001 kX). The constant a increases with oxygen content (c) to 3.0291 A when c = 0.5 at. % and to 3.0495 A when c = 3.2 at. %. A.F.Brown

548.735.4

4532. LATTICE PARAMETER DETERMINATION FROM BROAD DIFFRACTION LINES. E.R.Pike.
J. sci. Instrum., Vol. 35, No. 1, 34-5 (Jan., 1958).

The use of the centroid rather than the peak of each diffraction line is urged, because the correction for instrumental effects is then validly made by direct addition or subtraction, whatever the line profiles. A.R.Stokes

548.736

4533. STANDARD X-RAY DIFFRACTION POWDER PATTERNS. VII. DATA FOR 53 [INORGANIC] SUBSTANCES.
H.E.Swanson, N.T.Gilfrich and M.I.Cook.
Circ. Nat. Bur. Stand., No. 539 (Vol. 7), 68 pp. (1957).
For Pt VI see Abstr. 6741 (1957).

548.74

4534. ON THE ANOMALOUS STRUCTURE OF IRON CRYSTALS OBTAINED IN THE INITIAL STAGE OF CONDENSATION FROM VAPOUR. N.A.Shishakov.
Fiz. Metallov i Metallovedenie, Vol. 5, No. 1, 169-71 (1957).
In Russian.

Electron diffraction patterns of crystals deposited on celluloid

or mica in vacuum suggested a lattice constant 5% greater than normal. Certain hexagonally indexed reflections were interpreted in terms of the presence in the crystals of effectively two-dimensional hexagonal networks. C.H.L.Goodman

548.74: 538.245

4535. MAGNETIC EFFECTS ON THE ELECTRON DIFFRACTION PATTERNS FROM A COBALT CRYSTAL. M.Blackman and E.Grünbaum.
Proc. Phys. Soc., Vol. 71, Pt 5, 758-60 (May, 1958).

Electron diffraction patterns taken on the prism face of a cobalt crystal showed a distortion due to the magnetic leakage field of domains. The normal diffraction spots were replaced by a series of arcs. When the primary beam was moved parallel to the edge of the crystal, the distorted pattern changed with a period characteristic of the domain spacing. On heating the crystal, the magnitude of the distortion decreased, and became negligible at about 250°C. A.

GEOPHYSICS

550.34 : 538.2 : 534.2

SEISMIC WAVES IN CONDUCTING CORE OF THE EARTH. See Abstr. 3799

550.38 : 537.591

4536. THE EXTERNAL MAGNETIC FIELD OF THE EARTH. A.Beiser.
Nuovo Cimento, Vol. 8, No. 1, 160-2 (April 1, 1958).

Theoretical treatment of the problem of the earth's external magnetic field in relation to cosmic ray phenomena confirms the observation that the dipole component of the field (in the equatorial plane), caused by induced currents in the interplanetary plasma, is displaced to the westward of the surface-field component by 45°. D.R.Barber

550.38 : 538.122

ARC-LENGTHS ALONG THE LINES OF FORCE OF A MAGNETIC DIPOLE. See Abstr. 4123

550.383

4537. HIGH ALTITUDE MEASUREMENTS OF THE EARTH'S MAGNETIC FIELD WITH A PROTON PRECESSION MAGNETOMETER. L.J.Cahill, Jr and J.A.Van Allen.
J. geophys. Res., Vol. 61, No. 3, 547-58 (Sept., 1956).

A nuclear free-precession magnetometer of the Packard–Varian type was built and used for the precise measurement of the earth's magnetic field (scalar magnitude of total field vector) at high altitudes. The instrumentation, including the magnetometer head, amplifier, and radio telemetering transmitter, was carried to 100 000 ft altitude by a plastic Skyhook balloon. Signals were transmitted to a fixed ground station at 1 min intervals and the nuclear precession frequency was determined by standard frequency measuring techniques. Satisfactory signals were received until 2.5 hr after launching, at which time the balloon was near the radio horizon, approximately 200 miles from the ground station. The data showed a decrease in magnetic field intensity with altitude, as well as large variations in intensity with geographical position. A.

550.384 : 550.93

4538. VARIATIONS IN THE GEOMAGNETIC DIPOLE IN THE PAST 15000 YEARS. A.Beiser.
J. geophys. Res., Vol. 62, No. 2, 235-9 (June, 1957).

It is shown that the most likely cause of discrepancies between the ages t of archeological specimens determined from radio carbon measurements and the corresponding actual ages t' is a long-period variation in the magnetic dipole moment M of the earth. The relationship $\Delta M/M \cong 2\{\exp[-1.24 \times 10^{-4}(t' - t)] - 1\}$ is obtained. Comparison with the limited data available shows that, between roughly 5000 and 15000 years ago, any changes in M that persisted for times of the order of several thousand years could not have exceeded about 10% of the mean value of M in that interval. Shorter-period fluctuations could have been greater, particularly if oscillatory variations occurred. The approximate agreement between the current rate of production of radio carbon and the mean rate necessary to account for the existing radio carbon inventory extends this conclusion down to the present day, excluding the possibility that any major, long-term changes in the magnitude of the earth's magnetic field took place in the past 15000 years (approximately). A.

550.384

4539. A STUDY OF THE GEOMAGNETIC VARIATIONS DURING THE TOTAL SOLAR ECLIPSE OF 1955 JUNE 20. P.V.S.Narayan.
Kodaikanal Obs. Bull., No. 144, 18-28 (rec. Dec., 1957).

Geomagnetic variations observed at Hingurakgoda, Ceylon, during the total solar eclipse of 20 June 1955 were analysed for effects attributable to the eclipse. It was found the horizontal component of the earth's field decreased during the eclipse, the change commencing with the onset of the eclipse. The maximum departure was found to be 18 gammas and its occurrence was simultaneous with the total phase of the eclipse. This departure, expressed as a fraction of the deviation between the normal value at eclipse time and the value obtainable a few hours before dawn, was 0.29, which is very close to the value of 0.28 theoretically predicted by S.Chapman. The vertical component of the earth's field decreased until about the total phase, and then increased far above the normally anticipated value. This increase continued till about the end of the eclipse, after which it took up the usual diurnal course. A.

550.384.3

4540. LINEAR SECULAR OSCILLATION OF THE NORTHERN MAGNETIC POLE. E.R.Hope.
J. geophys. Res., Vol. 62, No. 1, 19-27 (March, 1957).

Modern data seem to support the thesis (van Bemmelen, 1899) that the secular motion of the northern magnetic pole is a nearly linear oscillation. This oscillation is along the axis of a great magnetic anomaly in the arctic. Except for the constraint of the anomaly the motion would probably be circular or quasi-circular, as suggested by the historical declination-dip curves. A.

550.384.3

4541. ROTATION, PULSE-DISTURBANCE, AND DRIFT IN THE GEOMAGNETIC SECULAR VARIATION. E.R.Hope.
J. geophys. Res., Vol. 62, No. 1, 29-42 (March, 1957).

The westward drift of surface geomagnetic patterns (the rate of which is about 30° of longitude per century) has at least one superimposed rotation of period ~ 480 years, and possibly another of period ~ 800 years; these are phenomena of a peculairly localized nature. The 480-year rotation is demonstrable not only in the curves of declination v. dip, but also in the isoporic patterns. A strong pulse-disturbance which occurred in the relative rotation of the terrestrial core, and therefore in the westward drift, is shown to affect the 480-year rotation in a manner which helps to clarify the relationships. See also preceding abstract. A.

550.384.3

4542. WESTWARD DRIFT AND CYCLIC SECULAR VARIATION. E.R.Hope.
J. geophys. Res., Vol. 62, No. 2, 241-53 (June, 1957).

In previous papers (see preceding abstracts), the rotary motion of the magnetic needle as displayed in Bauer's curves of secular variation was discussed on a descriptive basis. The present paper is an attempt to discuss the mechanism, and to relate it to the general westward drift of the surface geomagnetic field. The interpretation of the spherical harmonic analyses is considered. The essential conclusion is that the drift-rotation of the surface of the terrestrial core must be zonal, like that of the solar surface. This conclusion helps in accounting for the Bauer rotation. A.

550.385 : 523.75

4543. AN OBSERVATION OF AUDIO-FREQUENCY ELECTROMAGNETIC NOISE DURING A PERIOD OF SOLAR DISTURBANCE. J.M.Watts.
J. geophys. Res., Vol. 62, No. 2, 199-206 (June, 1957).

An analysis of hiss recorded during a magnetic storm shows that the spectrum has a peak near 3 kc/s, that the high frequency limit was variable during the period, and that a curious procession of narrow band-width tones gliding upward occurred during part of the period. A.

550.385

4544. SUB-AUDIBLE GEOMAGNETIC FLUCTUATIONS. H.J.Duffus, P.W.Nasmyth, J.A.Shand and C.Wright. Nature (London), Vol. 181, 1258-9 (May 3, 1958).

Oscillations of the natural electromagnetic background in the frequency range 0.1-30 c/s were detected. By playing back tape recordings at 1000 times the speed of recording, the low frequencies are shifted into the audible range to give both rising and falling whistles. These whistles appear to be especially frequent during magnetic storms; during quiet periods the whistles are usually of the falling type. G.M.Brown

550.385 : 551.594.5

4545. A NEW MODEL OF MAGNETIC STORMS AND AURORAE. S.F.Singer. Trans Amer. Geophys. Un., Vol. 38, No. 2, 175-90 (April, 1957).

To explain the sudden commencement (SC) of magnetic storms, the reverse sudden commencement (SC*), and pre-SC disturbances, the following model was invoked. The solar eruption produces a shock wave, which arrives at the earth 22 to 34 hr later. High-velocity particles having a smaller interaction precede the shock wave and cause the pre-SC bay-like disturbances at high latitudes. The shock wave itself is retarded by the body forces produced by the geomagnetic field, but speeds up as it enters the auroral zones. In pushing out lines of force, it creates the polar SC* events. Charge separation in the shock wave produces the driving force for the SC currents, which flow in the atmosphere (in accordance with Vestine's analysis). The storm decrease is produced by the high-velocity particles following the shock wave (up to 9 hr later), which enter because of field perturbations into the normally inaccessible Störmer regions around the dipole. Here they are trapped and will drift, producing the ring current that gives rise to the storm decrease. Particles with a small pitch angle, however, can reach the earth's atmosphere and contribute to aurora, the airglow, and ionospheric ionization. These particles are replenished by perturbations produced by solar influences having a 27-day recurrence. Many other particles are absorbed or scattered out of the trapping regions so that their number diminishes rapidly in a day or so, as does the magnetic-storm decrease. The model thus attempts to explain for the first time the cause of the SC*, the atmospheric nature of SC, the delay between SC and the main phase, and the formation and decay of the ring current. A by-product is auroral-particle acceleration by a shockwave. New experimental tests are suggested by the model. A.

550.385 : 551.594.5

4546. ON THE THEORY OF MAGNETIC STORMS AND AURORAE. H.Alfvén. Tellus, Vol. 10, No. 1, 104-16 (Feb., 1958).

Chapman–Ferraro's theory of magnetic storms is discussed. It is pointed out that the fundamental assumption about a non-magnetized beam is in conflict with cosmic ray evidence. It is further shown that there is a fundamental objection against any theory of the main phase based on a non-magnetized beam. The objections, which Cowling and Chapman have raised against the electric field theory, are discussed, and the discharge mechanism during a magnetic storm is analysed. When a magnetized beam enters the earth's magnetic field, it is heated due to the compression. In the hot plasma the earth will act as a "probe" so that it gets a negative charge in relation to the plasma. As a result of ambipolar diffusion to the earth, the ionosphere in the auroral zones will be bombarded by high energy protons and electrons. It is shown that a mechanism of this type is not subject to the objections that have been raised.

550.8

4547. DIPMETER CURVE COMPARATOR, AN OPTICAL AID TO THE INTERPRETATION OF DIPMETER DATA. M.Ferre and R.Kinnaird. Rev. sci. Instrum., Vol. 28, No. 9, 690-3 (Sept., 1957).

An optical instrument was designed to eliminate the printing and shifting of dipmeter logs for dip calculations. The instrument comprises sliding and rotating mirrors and provides two differently coloured images. Depth shift between curves thus can be determined easily and accurately. A.

551.243 : 539.2

4548. ON VOLTERRA'S DISLOCATIONS IN A SEMI-INFINITE ELASTIC MEDIUM. J.A.Steketee. Canad. J. Phys., Vol. 36, No. 2, 192-205 (Feb., 1958).

A Green's function method is developed to deal with the problem of a Volterra dislocation in a semi-infinite elastic medium in such a way that the boundary surface of the medium remains free from stresses. (A Volterra dislocation is here defined as a surface across which the displacement components show a discontinuity of the type $\Delta u = U + \Omega \times r$, where U and Ω are constant vectors.) It is found that the general problem requires the construction of six sets of Green's functions. The method for the construction is outlined and applied to one of the six sets, which is of the type of two double forces with moments in a plane parallel with the boundary. The displacement field thus generated is computed. Several of the results obtained are of geophysical interest. A.

551.311.123

4549. SURGES IN GLACIERS. J.F.Nye. Nature (London), Vol. 181, 1450-1 (May 24, 1958).

A theoretical explanation, based on the kinematic wave theory of Lighthill and Whitham, is suggested for the bulges of increased thickness that are known to travel down a glacier with a velocity of 3-4 times that of the normal flow and also for the erratic advance and retreat of glacier snouts. Scope for further theoretical and experimental work on glaciers is indicated. H.J.H.Starks

551.461 : 537.591.2

4550. THE APPLICABILITY OF THE Be^{10} METHOD TO THE MEASUREMENT OF THE COSMIC-RAY INTENSITY AND OF THE SEDIMENTATION VELOCITY OF DEEP-SEA SEDIMENTS OF SEVERAL MILLION YEARS AGE. B.Peters. Z. Phys., Vol. 148, No. 1, 93-111 (1957). In German.

The presence has previously been demonstrated of Be^{10} in sediments in the East Pacific in approximately predicted quantities. The present annual sedimentation of Be^{10} is estimated, and the relation discussed between the cosmic-ray intensity and (1) the sedimentation velocity of the deep-sea sediments, and (2) distribution of Be^{10} radioactivity in layers of varying ages. The estimated values are compared with the experimental results obtained in the Swedish Albatross expedition of 1947-48. The values obtained for the sedimentation velocity are somewhat higher than expected. The results are compatible with a cosmic-ray activity that has either remained constant or varied only relatively slowly during the last 1.5 to 3 million years. These conclusions are regarded as provisional until further experiments can be undertaken.

E.W.Kellermann

ATMOSPHERE. METEOROLOGY

551.508.71 : 535.34.07

4551. IMPROVED INFRARED ABSORPTION SPECTRA HYGROMETER. R.C.Wood. Rev. sci. Instrum., Vol. 29, No. 1, 36-42 (Jan., 1958).

An i.r. hygrometer is described, which utilizes a light beam as the principal sensing element. Composed of two narrow bands of i.r. radiation, this beam traverses a 12 in. path through a sample atmosphere containing the humidity concentration to be measured. Wavelength isolation is by means of germanium narrow band-pass interference filters. One band, centred near 2.60μ, is subject to attenuation by water vapour, the other located near 2.45μ is not. Thus the ratio of transmitted band energies is sensitive to the concentration of water vapour in the path. This ratio is effectively maintained at unity through use of a servo-operated glass wedge, which moves to compensate for energy unbalance caused by changes in absorbing vapour. The wedge position is converted into an electrical signal by a transducer, calibrated in terms of vapour density, (gm/m^3). Included in the design is a dry-gas purge standardization system whereby periodic checks of the zero point enable compensation for drift factors. Because of the potential use of the method in airborne applications, the instrument was used in tests to determine the character of pressure effects. These showed that vapour concentration W, total pressure P, and partial pressure p of water vapour, may be related to fractional absorption A by $A = CW^{0.5}(P + p)^{0.23}$. Conditions under which other, simpler relations may be used are discussed. A.

551.508.71 : 533.275

ELECTRIC HYGROMETERS. See Abstr. 3777

551.508.72 : 536.423

4552. AN INSTRUMENT FOR MEASURING EVAPORATION FROM NATURAL SURFACES. R.J.Taylor and A.J.Dyer. Nature (London), Vol. 181, 408-9 (Feb. 8, 1958).

The equipment, which is described in reasonable detail, permits the automatic, direct determination of natural evaporation by equating

it to the vertical turbulent flux of water vapour in the layers of air near to the ground. There is no restriction on the nature of the surface provided that it has good horizontal uniformity. A new design of anemometer, which depends in its operation on measuring the temperature in the wake of a heated wire, is used in the instrument.
H.C.Cole

551.510.3

4553. UPPER AIR PRESSURE AND DENSITY MEASUREMENTS FROM 90 TO 220 KILOMETERS WITH THE VIKING 7 ROCKET.
R.Horowitz and H.E.LaGow.
J. geophys. Res., Vol. 62, No. 1, 57-78 (March, 1957).

The density and pressure of the atmosphere from 90 to 220 km above White Sands, New Mexico, were determined from the Viking 7 rocket flight on 7 August 1951 at 11.00 a.m. M.S.T. A Philips ionization gauge was used to measure pressure and pressure changes on the side of the nose cone of the rolling rocket. Measured pressures in the 90 to 105 km region were corrected for velocity ram and residual gas, and were approximately a quarter of the Rocket Panel values. The derived pressure of 3×10^{-7} mm Hg at 220 km is twice the corresponding Rocket Panel value. Densities were measured from 120 to 185 km and at 220 km. The 220 km density value of 9×10^{-8} g/m^3 agrees with the Rocket Panel value. However, the density values at the lower altitudes are a quarter to a half those of the Rocket Panel. These lower density values in the 100 to 130 km region are in good agreement with values obtained from X-ray absorption experiments. Scale heights derived from the density data above 140 km, are approximately a factor of two higher than Rocket Panel values. A.

551.510.3 : 535.43

4554. PULSED SEARCHLIGHTING THE ATMOSPHERE.
S.S.Friedland, J.Katzenstein and M.R.Zatzick.
J. geophys. Res., Vol. 61, No. 3, 415-34 (Sept., 1956).

An optical pulsed-searchlight system was developed for measuring the density profile of the upper atmosphere. A light source, which emits a 50 Mlm pulse, 20 μsec in duration, is placed at the focal point of a 60 in. mirror. A photomultiplier, which is part of a logarithmic recording system covering a dynamic range of four orders of magnitude, is placed at the focal point of a similar mirror. Each time the light is pulsed, an entire density profile is obtained. An altitude above 40 km was observed. Suggestions and methods for obtaining signals from higher altitudes are discussed. The data obtained to date agree with the results of previous investigators and with theoretical calculations. A.

551.510.3

4555. PHYSICAL PROPERTIES OF THE ATMOSPHERE FROM 90 TO 300 KILOMETERS.
H.K.Kallmann, W.B.White and H.E.Newell, Jr.
J. geophys. Res., Vol. 61, No. 3, 513-24 (Sept., 1956).

Based on recent experimental and theoretical studies of the physical properties of the atmosphere at high altitudes, an average model atmosphere is presented for the region between 90 and 300 km. This model is consistent with the following assumptions: (1) molecular oxygen begins to dissociate appreciably only above 90 km; (2) at about 130 km, approximately 30% of O_2 is still in the undissociated state; (3) molecular nitrogen begins to dissociate above 220 km; (4) the concentrations of molecular oxygen and nitrogen decrease with altitude exponentially; (5) the temperature becomes isothermal in the region of the exosphere, approximately above 360 km. All physical quantities were calculated from self-consistent equations as continuous functions of altitude, without assuming any particular form of the temperature gradient. The results show lower temperatures and densities throughout the region of the ionosphere than have been deduced previously. A.

551.510.3

4556. ERRATUM IN ARTICLE, "PHYSICAL PROPERTIES OF THE ATMOSPHERE FROM 90 TO 300 KILOMETERS".
H.K.Kallmann, W.B.White and H.E.Newell, Jr.
J. geophys. Res., Vol. 62, No. 1, 168 (March, 1957).
See preceding abstract.

551.510.3

4557. COMMENTS CONCERNING THE KALLMANN–WHITE–NEWELL ARTICLE, "PHYSICAL PROPERTIES OF THE ATMOSPHERE FROM 90 TO 300 KILOMETERS". G.J.Simmons.
J. geophys. Res., Vol. 62, No. 2, 327-8 (June, 1957).
See preceding abstract.

551.510.4

4558. ROCKET INVESTIGATIONS OF THE COMPOSITION OF THE ATMOSPHERE AT GREAT HEIGHTS. B.A.Mirtov.
Uspekhi fiz. Nauk, Vol. 63, No. 1b, 181-96 (1957). In Russian.

The six main problems involved in upper atmosphere composition studies (pressure measurement, temperature measurement, nature of ionizing particles, the gravitational distribution of gases, dissipation of an atmosphere into world space, corpuscular emission from the sun) are discussed, together with methods of investigating experimentally. C.R.S.Manders

551.510.534

4559. THE VERTICAL FLUX OF ATMOSPHERIC OZONE.
V.H.Regener.
J. geophys. Res., Vol. 62, No. 2, 221-8 (June, 1957).

The downward flux of atmospheric ozone near the earth's surface is evaluated from recordings in Nebraska of the vertical profile of ozone and from simultaneous data on the wind profile and on the shearing stress at the surface. Furthermore, recordings of the ozone concentration in New Mexico at two levels, 4000 ft apart in altitude, are used, together with the previously determined flux value, for an estimate of the coefficient of exchange in the atmosphere between the two stations. The observed differences in the ozone concentration at the two stations are also examined in relation to wind and temperature. A.

551.510.534

4560. A METHOD FOR THE DETERMINATION OF THE VERTICAL OZONE DISTRIBUTION FROM A SATELLITE.
S.F.Singer and R.C.Wentworth.
J. geophys. Res., Vol. 62, No. 2, 299-308 (June, 1957).

Because of its long lifetime below 45 km, ozone can deviate markedly from the concentration given by photochemical equilibrium considerations. Hence the ozone concentration can be used as an indicator of the motion of air masses, particularly in the stratosphere. The meteorological implications can be fully realized only by synoptic measurements, for which an artificial earth satellite is ideally suited. The method employs the optical absorption properties of ozone in the u.v. region around 2900 A. A detector looking down towards the earth will receive solar u.v. light scattered by the atmosphere, which has been attenuated both by scattering out and by ozone absorption. Calculations are presented to illustrate the effective depth in the atmosphere to which the detector "sees", the effective depth being defined as the point above which 90% of the contribution to the detector response is made. The sensitivity of the method to changes in the ozone concentration at various altitudes is also demonstrated. A.

551.510.534

4561. OZONE IN THE STRATOSPHERE. I.A.Khvostikov.
Uspekhi fiz. Nauk, Vol. 59, No. 2, 229-323 (1956). In Russian.

A review of recent work with a bibliography of 134 references, of which about 20 cover Soviet contributions. Topics discussed are: experimental methods of investigation and results; the theory of the ozonosphere, its nature and the vertical distribution of ozone; the ozone layer and its connection with the weather; heat balance of the ozonosphere. C.R.S.Manders

551.510.535/.536

4562. THE TRANSITION FROM THE IONOSPHERE TO INTERPLANETARY SPACE. D.E.Blackwell.
Nature (London), Vol. 181, 1237-8 (May 3, 1958).

Report of a discussion held at the Royal Astronomical Society on 21 February 1958. Various speakers summarized results obtained for the ionization density above the peak of the F2 layer. Information is now available from studies of radio echoes from the moon, radio signals received from artificial satellites, observations of the zodiacal light, and work on a.f. atmospherics (whistlers). Most evidence suggests that the electron density falls off rather slowly above the F2 layer. The report includes an account of an idealized static model of the complete solar corona extending to the boundaries of the solar system, as given by S.Chapman.
G.M.Brown

551.510.535

4563. ON THE CORRELATION BETWEEN IONOSPHERIC ELECTRON DENSITY AND SOLAR ACTIVITY. F.Mariani.
Ann. Geofis., Vol. 10, No. 1-2, 71-87 (Jan.-April, 1957). In Italian.

The variation of monthly median values of maximum electron density N of the F2 layer with sunspot number R has been studied

for about 20 stations between 52°N and 43°S over the period 1949-54. For noon values, the assumption of a linear relation between N and R leads to a sensitivity index which is greater in the northern than in the southern hemispheres. However, a better fit is obtained using a variation of the form $N = N_0(1 + \beta R + \gamma A)$, where A is another index of solar activity such as the area of hydrogen filaments, and in this case the hemisphere-asymmetry appears in the values of γ, with sensibly constant values of β. For midnight values, the dependence on A remains, but there is no asymmetry between the hemispheres. More limited results for the F1 and E layers also indicate little asymmetry. Possible explanations of the F2 noon asymmetry are considered. G.M.Brown

551.510.535

4564. ON THE ORIGIN OF RADAR ECHOES ASSOCIATED WITH AURORAL ACTIVITY. J.Meos and S.Olving.
Chalmers Tekn. Högsk. Handl., No. 196, 20 pp. (1958).

An account of results obtained in 1953 at Kiruna (67.8°N) using a 30.3 Mc/s radar equipment giving P.P.I. display during 102 geomagnetic storms. A panoramic ionosonde was also operated at the same times, together with photographic recording of visual auroral forms. The observations do not support the theory of Harang and Landmark (Abstr. 5189/1954) that echoes of this type are due to ground backscatter following reflections at intense Es layers. It is concluded further that most of the echoes do not originate from the luminous parts of aurorae, but the general coincidence between the optical and radio phenomena suggests that the echoes originate directly from scattering at ionized forms lying along the geomagnetic field and situated in the E layer. It is proposed that the echoing ionization be termed the "ionized aurora"; this is not always manifested by luminosity, but probably has the same origin as the visible aurora. G.M.Brown

551.510.535

4565. FORMATION OF THE LOWER IONOSPHERE.
K.Watanabe, F.F.Marmo and J.Pressman.
J. geophys. Res., Vol. 60, No. 4, 513-19 (Dec., 1955).

According to new absorption data on O_2 and N_2 in the spectral region 850-1100 A, photoionization of atmospheric O_2 at its first ionization potential should occur in the E layer rather than in the D layer. In particular, Lyman beta in the solar spectrum is expected to be an important line, as it can ionize O_2 while it is quite transparent to N_2. A flux of about 10^9 photons cm^{-2} sec^{-1} for this line can account for the lower E layer, while the higher region may be in part ascribed to an observed preionization of the Hopfield bands. Thus, it is not possible yet to reject the oxygen theory in favour of the X-ray theory of the E layer. A.

551.510.535 : 533.16

4566. VISCOSITY IN THE F REGION.
J.W.Dungey and A.J.Willson.
J. geophys. Res., Vol. 60, No. 4, 521-3 (Dec., 1955).

The problem of viscosity for disturbances whose scale is smaller than the mean free path is dealt with by means of Boltzmann's equation. It is shown that the phenomenon cannot be described by an "effective coefficient of viscosity" and that viscosity is of primary importance under these conditions. The implications for the aerodynamics of the F region are discussed. A.

551.510.535 : 536.23

4567. TEMPERATURE DISTRIBUTION OF THE IONOSPHERE UNDER CONTROL OF THERMAL CONDUCTIVITY. F.S.Johnson.
J. geophys. Res., Vol. 61, No. 1, 71-6 (March, 1956).

The effect of thermal conductivity in controlling the temperature distribution of the high atmosphere is considered. The energy absorbed in the F region is conducted downward into a denser region of the atmosphere, where it is dissipated by i.r. emission. The calculations indicate that the atmosphere is isothermal above about 250 km, and that between 100 and 200 km there is a very strong positive temperature gradient. The temperature in the isothermal region is assumed to be 1100°K, in order to provide enough atmosphere near 300 km to support an F2 region. The low temperature at 80 km is due primarily to the lack of absorbed energy there rather than to the presence of a strongly emitting layer at that level. A.

551.510.535

4568. DRIFT MEASUREMENTS OF THE E-LAYER.
L.Harang and K.Pedersen.
J. geophys. Res., Vol. 62, No. 2, 183-98 (June, 1957).

The drift of the E layer diffraction pattern on the ground was recorded at Kjeller (ϕ = 59° 58' N, λ = 10° 06' E) on 2 Mc/s during the period June 1953 to September 1955. Three receiving points were put up and the amplitudes of the E echoes were recorded (Mitra method). The time shifts between the maxima in the fading curves were recorded automatically by means of a Phillips recorder, or optically on a three-beam oscillograph. The mean diurnal values of the east–west and north–south components of the drift in meters per second are given for the four seasons. The seasonal and annual curves were analysed and the mean values compared with the results from similar recordings at Cambridge, Washington and Ottawa. There is a constant term indicating a prevailing drift towards southwest in winter and towards northeast in summer. There is a solar 12 h term appearing during all seasons of the year. The mean annual values of phase and amplitude of this term at Kjeller are very similar to the corresponding term at Cambridge. The summer values were analysed for a lunar term, and a small but doubtful component appeared. During daytime, there is no systematic change in the wind-directions on days with Es or normal E. At sunset, when the electron density of the normal E layer is too low for reflecting the test frequency 2 Mc/s, there is a sudden change in the direction of the east-west component. The Es layer recorded after sunset and during the night has a strong westerly component. On account of the width of the gate, it is not possible to decide if this is a height effect. Another explanation is that the diffraction pattern during night-time is not isotropic, but has a preferred orientation in north-south direction. This will simulate a strong increase in the east-west component of the drift. It is pointed out that the probability distribution along the north–south direction is systematically narrower than along the east-west direction. Examples of very narrow probability distribution in north–south direction at night are given. The conclusion to be drawn is that there seems to be a preferred orientation in north–south direction of the lines of maxima during daytime, which during night-time may appear as very predominant. A.

551.510.535

4569. V.L.F. PHASE SHIFTS ASSOCIATED WITH THE DISTURBANCE OF FEBRUARY 23, 1956. J.A.Pierce.
J. geophys. Res., Vol. 61, No. 3, 475-83 (Sept., 1956).

During the magneto-ionic disturbance following a solar flare at about 03h 34min U.T. on 23 February 1956, the phase of a signal received at Cambridge, Massachusetts, at 16 kc/s from a transmitter at Rugby, England, was advanced by about 44 μsec or 250°. The peak Doppler effect on the received frequency occurred at 03h 47min, and corresponded approximately to a falling of the effective height of reflection at 1 km/min, assuming that the phase change was produced solely by a change in height. The record of this phenomenon is contrasted with those made during daytime sudden ionospheric disturbances. It is shown that in the latter case an increase in signal amplitude is observed at 60 kc/s but not at 16 kc/s, and that there must be changes in the phase shift at reflection from the ionosphere, as well as changes in the height of reflection. Some comparisons are given between the time of occurrence of this phenomenon and the times of various other effects of this disturbance that have already been reported. A.

551.510.535

4570. IONOSPHERIC F2 LAYER BEHAVIOUR DURING THE ECLIPSE OF JUNE 20, 1955. B.N.Bhargava and R.V.Subrahmanyan.
Kodaikanal Obs. Bull., No. 144, 5-10 (rec. Dec., 1957).

The effects are described of the partial solar eclipse (magnitude 0.91) of 20 June 1955, on the electronic density, height and layer-shape of the F2 region over Kodaikanal. Although the ionic density of the F2 layer was affected perceptibly before first ground contact, the overall effect was a delayed one, the maximum effect on the ionic density having been observed 18 min after the maximum phase of the eclipse. Recovery in ionic density was gradual and was attained about 2 hr after the end of the eclipse. These effects were examined in relation to coronal and sunspot activities on the eclipse day. It is found that the F2-layer ionizing-radiation appears to originate in a slightly enhanced form from active regions asso iated with sunspots, and possibly with active coronal regions. An extraordinary phenomenon consisting of a rapid upward drift of the F2 layer after maximum phase of the eclipse is noted. A new stratification appeared, intermediate between the F1 and F2 layers, soon after the maximum phase of the eclipse, and developed into a well defined layer. This layer registered an almost fourfold increase in ionic density and eventually replaced the F2 region that existed before the eclipse. A.

551.510.535

4571. THE EFFECT OF THE SOLAR ECLIPSE OF 20TH JUNE 1955 ON THE LOWER IONOSPHERIC LAYERS.
S.Rangarajan and J.V.Narayana.
Kodaikanal Obs. Bull, No. 144, 11-17 (rec. Dec., 1957).

Soundings of the ionosphere were made at 1 min intervals at the Kodaikanal Observatory. The behaviour of the lower ionosphere, comprising the F1, E and D layers, during the eclipse is discussed. By a detailed analysis of the variation of ion-density of the E layer throughout the progress of the eclipse, it is shown that solar radiation responsible for the formation of this layer is not distributed uniformly over the sun's disk. The vicinity of an active sunspot group situated on the south-west quadrant of the sun was found to be a discrete source of intense radiation. The behaviour of the F1 and D layers suggests that the ionization in these layers is enhanced also by the intense radiation from the vicinity of the active sunspot group. A.

551.510.535

4572. THE ELECTRICAL CONDUCTIVITY OF THE IONOSPHERE: A REVIEW. S.Chapman.
Nuovo Cimento Suppl. (Ser. 10), Vol. 4, No. 4, 1385-412 (1956).

The various effective specific conductivities of the ionosphere are considered, as follows: k_0 = conductivity in the absence of a magnetic field, or in the presence of a magnetic field (F) which is parallel to the electric field (E); k_1 = conductivity for current flow in the direction of E when this is perpendicular to F; k_2 = conductivity for "Hall current" at right angles to E when this is also at right angles to F; k_3 = conductivity when E and F are perpendicular, but when Hall currents are prevented from flowing by polarization. These four parameters are first calculated on the basis of mean-free-path theory, and the results compared with those derived by other workers. They are then determined more rigorously, considering different types of ionized gas mixture. Numerical values are derived for two model ionospheres, based on rocket measurements over White Sands. The variation of conductivity with latitude is also considered. G.M.Brown

551.510.535 : 621.396.8

4573. ECHO SOUNDING EXPERIMENTS WITH VARIABLE FREQUENCY AT OBLIQUE INCIDENCE.
W.Dieminger and H.G.Möller.
Nuovo Cimento Suppl. (Ser. 10), Vol. 4, No. 4, 1532-45 (1956).

A pulse technique whereby it is possible to obtain P'f records (ionograms) at oblique incidence is briefly described. Synchronization of receiver and transmitter is achieved by deriving all controls from a pair of crystal clocks. Several specimen ionograms are reproduced, and values of the m.u.f. obtained are compared with the corresponding ones conventionally derived by the transmission-curve method applied to vertical-incidence ionograms. Interesting conclusions are reached with regard to high-angle and low-angle paths for single- and multiple-hop transmissions. G.M.Brown

551.510.535

4574. ON SOME CHARACTERISTICS OF THE F_2 REGION IN SOUTH AMERICA. I.Ranzi.
Nuovo Cimento Suppl. (Ser. 10), Vol. 4, No. 4, 1559-61 (1956).

Two phenomena are mentioned: (1) The F2 layer at Buenos Aires is observed to contract markedly some 3-4 hours before sunrise, sometimes reaching a minimum virtual height of about 190 km, followed by a very rapid expansion. (2) At Deception Island, in western Antarctica, f_0F2 shows a marked summer midday decrease, such that the maximum occurs at about 23 hours. The phenomena are probably related to the effects of horizontal and vertical drifts of ionization respectively, associated with the dynamo currents. G.M.Brown

551.510.535

4575. SOME CONSIDERATIONS ON TEMPERATURE EFFECTS IN THE UPPER ATMOSPHERE. F.Mariani.
Nuovo Cimento Suppl. (Ser. 10), Vol. 4, No. 4, 1579-85 (1956).

It is concluded that the diurnal variations of temperature in the F2 layer are small and cannot account for the anomalous diurnal behaviour of f_0F2. An atmospheric model with a constant temperature gradient to a height c, and zero gradient above this height, is found to account for several observations on the F layer, if it is assumed that the "F1 cusp" observed on ionograms is caused by the discontinuity of the gradient of recombination coefficient at the height c. G.M.Brown

551.510.535

4576. DIFFUSION IN A NOT ISOTHERMAL IONOSPHERE.
F.Mariani.
Nuovo Cimento Suppl. (Ser. 10), Vol. 4, No. 4, 1586-8 (1956).

The effects of diffusion are calculated for an ionosphere consisting of a binary mixture of an ion–electron and a molecular gas. Tentative numerical results show that the effects are mostly small, especially for the E and F1 layers, but may become important in the lower part of the F2 layer. G.M.Brown

551.510.535

4577. VERTICAL SOUNDINGS AT AHMEDABAD DURING PARTIAL SOLAR ECLIPSE ON 14TH DECEMBER 1955.
R.G.Rastogi.
Proc. Indian Acad. Sci. A, Vol. 47, No. 2, 65-76 (Feb., 1958).

Results of critical frequency and minimum equivalent height measurements for all the layers observed at Ahmedabad are given. The variation of foE was roughly consistent with that of a Chapman layer with $\alpha \sim 0.8 \times 10^{-8}$. There was no clear effect of the eclipse on the E1 and E2 layers, although the critical frequencies were in general lower on the eclipse day; the Es layer was unaffected. The variation of foF1 was irregular but showed a decrease; foF2 was higher on the eclipse day than on the control days, but the rate of increase of foF2 was reduced. There were indications of the formation of an $F1\frac{1}{2}$ layer during the latter part of the eclipse. G.M.Brown

551.510.535

4578. ANOMALOUS VARIATION OF TOTAL ABSORPTION OF RADIO WAVES REFLECTED FROM THE F2 REGION OF THE IONOSPHERE AROUND MID-DAY. S.K.Sharma.
Proc. Phys. Soc., Vol. 71, Pt 6, 1007-10 (June, 1958).

Measurements of total absorption in the ionosphere were made at vertical incidence by pulse technique on various frequencies during the day. It was observed that at lower frequencies a single maximum is generally obtained after mid-day due to sluggishness of the lower absorbing layers as suggested by Appleton. At frequencies higher than the critical frequency of the F1-layer, however, two such maxima are observed, one before and the other after the local noon. This anomaly was attributed to the thermal expansion of the F2-region of the ionosphere, the effect of which is usually observed before mid-day. A.

551.510.535

4579. ELECTRON DENSITY FLUCTUATIONS AND SCATTERING OF RADIOWAVES IN THE IONOSPHERE. Ya.L.Al'pert.
Zh. éksper. teor. Fiz., Vol. 33, No. 1(7), 213-25 (1957). In Russian.

Results are presented of measurement of electron density fluctuations obtained by measuring the "coefficient of opaqueness" of the ionosphere and the energy of ultra-short waves scattered in the ionosphere. Linear inhomogeneity dimensions ξ at an altitude of 80 km, which effectively participate in the scattering of ultra-short waves, are determined. The calculations are based on the expression for the effective scattering cross-section obtained for the correlation coefficient $\rho(r) \sim e^{-(r/\xi)^2}$. The conclusion is reached that, when vertical probing of the ionosphere is carried out at frequencies below the critical frequency, the detected scattered field is mainly due to waves scattered in the forward direction and subsequently reflected from higher levels in the ionosphere. When the ultra-short waves travel large distances through the ionosphere at an oblique angle the main role in scattering is played by inhomogeneities of optimal dimensions. A.

551.510.535

RADIO-WAVE PROPAGATION IN THE IONOSPHERE. See also under "Electromagnetic waves and oscillations". Decimal classification 538.566.3

551.510.535 : 538.566.3

IONOSPHERIC REFLECTION COEFFICIENTS AT VERY LOW RADIO FREQUENCIES. See Abstr. 4189

551.510.535 : 538.566.3

RADIO FREQUENCY AND SCATTERING ANGLE DEPENDENCE OF IONOSPHERIC SCATTER PROPAGATION AT V.H.F. See Abstr. 4190

551.510.535 : 538.566.3

DIURNAL VARIATIONS OF SIGNAL LEVEL AND SCATTERING HEIGHTS FOR V.H.F. PROPAGATION. See Abstr. 4191.

551.513.1

4580. THERMAL AND GRAVITATIONAL EXCITATION OF ATMOSPHERIC OSCILLATIONS. H.K.Sen and M.L.White.
J. geophys. Res., Vol. 60, No. 4, 483-95 (Dec., 1955).

Previous work on the excitation of large-scale oscillations in an atmosphere on a rotating globe is extended to include a unified treatment for both gravitational and thermal forcing functions and is applied to the solar and lunar semi-diurnal pressure variation, that is S_2 and L_2, respectively. It is assumed that the heating is applied only at the base of the atmosphere and that the temperature gradient is constant in this region as in the actual troposphere. The solution of the problem consists of the usual Bessel's functions characteristic of a purely gravitational forcing function found by Pekeris (Abstr. 1123/1937), plus a particular integral found by the method of variation of parameters. The total resonant amplification is obtained for the various atmospheric models used by Jacchia and Kopal (J. Meteorol., Vol. 9, 13, 1952). The hitherto neglected phase of the dynamical tidal oscillation is included in a treatment where complex variables are systematically employed to represent the magnitude and phase of observables. It is found that current atmospheric models favour the conclusion that thermal effects are far more important than the gravitational in producing the S_2 variation ($\cong 15$) as compared with Chapman's (1924) conclusion that they are of nearly equal importance. However, if one assumes, as did Chapman, that eddy motion at the ground is the only heating source, then our conclusion is at odds with observed values of eddy conductivity found by Eiffel Tower measurements. A possible resolution of this paradox is the consideration of other heating sources. Balloon observations by Riehl and the analysis of Haurwitz are cited in support of this possibility. A.

551.513.1

4581. EXTENSION OF THE SEN—WHITE PAPER ON ATMOSPHERIC OSCILLATIONS. M.L.White.
J. geophys. Res., Vol. 60, No. 4, 531-2 (Dec., 1955).

551.513.1

4582. GRAVITATIONAL AND THERMAL OSCILLATIONS IN THE EARTH'S UPPER ATMOSPHERE. M.L.White.
J. geophys. Res., Vol. 61, No. 3, 489-99 (Sept., 1956).

The work of Sen and White (see preceding abstracts) on the excitation of large-scale oscillations in an atmosphere on a rotating globe by gravitational and thermally induced forces is extended to include heating in any portion of the atmosphere. The region where the heating occurs is unrestricted regarding temperature profile. The solution $\chi(z)$ of the radial differential equation of motion consists of (1) a complementary function y exp (x/2), and (2) a particular solution $q(z)/\gamma H(z) + \exp(x\lambda 2)\, I(x)$, where I is obtained by intergrating the heat source function (with appropriate weight factor) from the top of the atmosphere to the level in question, γ is the ratio of specific heats, H(z) is the scale height, $x = \int dz/H$ (where z is the altitude), q is the heat source function, and $\chi(z)$ is the divergence of the velocities. With this representation of the wave function, one recovers the expressions for the velocity components and pressure variations of Pekeris (Abstr. 1123/1937) and of Weekes and Wilkes (Abstr. 467/1948) for the purely gravitational case, provided the wave function y is replaced by [y + I]. General expressions are also obtained for the vertical and horizontal displacements and for the amplification over equilibrium tide at any level. The latter expression is useful for establishing the so-called solar control of the dynamics of a given layer by radiation absorbed in any other layer. The boundary conditions of Weekes and Wilkes are shown valid for a "top" with constant positive temperature gradient, believed to be the case above 100 km. Finally, the solar and lunar semi-diurnal winds as collected by Briggs and Spencer (Rep. Progr. Phys., Vol. 17, 245/1945) for the E region when tested by present theory are found to have the same azimuthal dependence as exists at the ground. This is consistent with the original assumption of "variables separable". A.

551.513.1 : 533.15

THEORY OF MOLECULAR DIFFUSION IN THE ATMOSPHERE. See Abstr. 3776

551.521

4583. A DIRECT MEASUREMENT OF INFRA-RED RADIATION DIVERGENCE TO 160 mb. V.E.Suomi, D.O.Staley and P.M.Kuhn.
Quart. J. Roy. Meteorol. Soc., Vol. 84, 134-41 (April, 1958).

A simple, economical balloon-borne net radiometer is described. The net radiation is essentially obtained from the difference of fourth-powers of the temperatures of the bottom and top radiating surfaces, and the internal conduction, which is proportional to the temperature difference between the bottom and top surfaces. The results of a measurement of net radiation to 160 mb are discussed. A.

551.524.7

4584. TEMPERATURES IN THE HIGH ATMOSPHERE. F.S.Johnson.
Ann. Géophys., Vol. 14, No. 1, 94-108 (1958).

The temperature distribution of the high atmosphere is discussed on the assumption that the ionosphere is heated primarily by solar radiation and that the temperature distribution is controlled by thermal conduction. A model is presented which agrees well with rocket observations and with most of the radio observations, and in which the thermal conduction is consistent with the absorption of solar energy. The amounts of solar energy are in agreement with the rocket observations in those spectral regions in which observations were made. However, no observations were made in the spectral region that is most important with regard to controlling the temperature of the F region of the ionosphere. The amount of solar energy, which must be assumed to be present in this spectral region in order to give a thermally consistent model with temperatures as high as those required by rocket and radio observations, is not unreasonable from an astrophysical viewpoint. A.

551.524.7

4585. ON THE COOLING OF THE UPPER ATMOSPHERE AFTER SUNSET. A.N.Lowan.
J. geophys. Res., Vol. 60, No. 4, 421-9 (Dec., 1955).

The cooling of the "upper atmosphere" (region between the altitude $h_0 = 100$ km and the altitude $h_1 = 380$ km) after sunset was investigated under the assumptions that (a) the temperature at h_0 is constant and equals 240° K, (b) the temperature gradient at h_1 is zero, and (c) the process of heat transfer takes place solely by conduction. Assumed initial temperature is that given by the Rocket Panel, ranging from 240° K at h_0 to 1250° K at h_1. The thermal conductivity K and specific heat c were assumed constant, and the dependence of the density ρ on temperature was ignored, the differential equation of heat conduction being solved numerically on the assumption that the density ρ — and, therefore, the thermal diffusivity $\alpha = K/c\rho$ — varies with altitude but is independent of time (the variation of ρ with altitude being that given by the Rocket Panel). The computations revealed that after $2\frac{1}{2}$ h the temperature has not changed at altitudes below 160 km, and that the maximum drop at h_1 is 440° K. From the computed temperatures at time t = 2 h, the densities were computed. Computations revealed that a certain settling of the atmosphere takes place, the densities at time t = 2 h being larger than at time t = 0 in some region, and correspondingly lower at altitudes above the upper limit of this region. Analysis of the ion density led to the conclusion that there is an appreciable increase of the ion density in the F layer, in spite of the recombination of ions which takes place after sunset.

551.547

4586. PRESSURE MEASUREMENT IN THE UPPER ATMOSPHERE. V.V.Mikhnevich.
Uspekhi fiz. Nauk, Vol. 63, No. 1b, 197-204 (1957). In Russian.

The apparatus (using an unstabilized container) and results of pressure measurements at heights of 50-100 km are discussed. C.R.S.Manders

551.557

4587. CIRCULATION IN THE UPPER ATMOSPHERE. P.S.Pant.
J. geophys. Res., Vol. 61, No. 3, 459-74 (Sept., 1956).

The winds in the region of the atmosphere from 20 to 100 km elevation over the northern hemisphere are critically examined. The summer and winter temperatures are computed from the wind field with the aid of rocket mean pressure data and under the assumption that the wind field is geostrophic. The temperatures obtained are found to agree with direct observations. Thus the observed wind and temperature distributions are shown to be consistent. Possible causes of some of the observed seasonal temperature changes in different parts of the upper atmosphere are discussed. The zonal wind cross-sections prepared in this investigation are compared with wind distributions published earlier and found to agree fairly well with them. On the basis of the wind distributions and of theoretical considerations, the circulation in the mesosphere and thermosphere is derived. A.

551.557

4588. ON THE ATMOSPHERIC CIRCULATION AT 500 mb IN THE AURORAL BELT. H.Riehl.
J. geophys. Res., Vol. 61, No. 3, 525-34 (Sept., 1956).

The 500 mb circulation along the auroral belt is calculated for the period December 1954 to June 1955 with a view toward determining whether circulation changes in the belt are related to preceding solar disturbances, especially corpuscular streams. Such a relation is not found; however, circulation increases and decreases take place with a period which can be related to the mean solar rotation in the equatorial zone. Changes in wind are produced by mechanical momentum convergence as in the temperate zone westerlies. A.

551.574.7 : 537.564

IONIZED RADIOACTIVE PARTICLES AS CONDENSATION NUCLEI. See Abstr. 4088

551.578.11 : 551.594.14

4589. ANNUAL DEPOSITION OF COSMIC RAY PRODUCED Be^7 AT EQUATORIAL LATITUDES. Rama Thor and P.K.Zutshi.
Tellus, Vol. 10, No. 1, 99-103 (Feb., 1958).

The concentration of cosmic-ray produced Be^7 in rain water was measured at two stations in the equatorial latitudes. Its rate of deposition at the earth's surface was estimated to be about 5×10^5 atoms cm^{-2} yr^{-1}, and the deposited quantity seems to be independent of latitude. A.

551.593.55 : 535.331

4590. CONSIDERATIONS REGARDING THE SODIUM LINES IN THE NIGHTGLOW AND TWILIGHT. A.Omholt.
J. geophys. Res., Vol. 62, No. 2, 207-12 (June, 1957).

Some photochemical processes of importance for the emission of the Na lines in twilight and nightglow are discussed. The most important oxidation process is taken to be $Na + O_2 + M \rightarrow NaO_2 + M$. Lack of information about the rate coefficients involved prevents precise quantitative computations, but it is found that photochemical reactions may explain the formation of the emitting layers and the nightglow intensity. However, no satisfactory interpretation of the large seasonal variation has so far been given. Photochemical reactions, as well as photo-ionization of sodium, seem insufficient to explain the observations. A.

551.593.7.08

4591. A POLARIMETER FOR THE STUDY OF ULTRAVIOLET RADIATION FROM THE SKY. Y.Bouriau and J.Lenoble.
Rev. Opt., Vol. 37, No. 3, 131-46 (March, 1958). In French.

Methods available for the measurement of small amounts of polarization are reviewed, and their application to the ultraviolet region considered. A polarimeter is described which uses a rotating birefringent plate to modulate the polarized portion of the incident beam. A photomultiplier and a tuned amplifier then measure the amount of modulation. Practical details of the equipment and the method of calibration are given, with sample results. R.W.Fish

551.594.14

4592. MEASUREMENT OF ARTIFICIAL RADIOACTIVITY IN THE ATMOSPHERE AT OTTAWA, CANADA. F.Terentiuk.
Canad. J. Phys., Vol. 36, No. 1, 136-9 (Jan., 1958).

Measurements extending over a year (May 21, 1956 to May 21, 1957) were made by measuring daily the gross β-activity collected on a filter in a high-volume air sampler. Atmospheric activities up to $\sim 10^{-14}$ c/l. were obtained following a series of reported nuclear explosions. A.O.Stanesby

551.594.14

4593. METEOROLOGICAL FACTORS AFFECTING SPREAD OF RADIOACTIVITY FROM NUCLEAR BOMBS. L.Machta.
J. Washington Acad. Sci., Vol. 47, No. 6, 169-79 (June, 1957).

551.594.14

4594. GLOBAL DISTRIBUTION OF RADIOACTIVITY FROM NUCLEAR DETONATIONS, WITH SPECIAL REFERENCE TO STRONTIUM^{90}. M.Eisenbud.
J. Washington Acad. Sci., Vol. 47, No. 6, 180-8 (June, 1957).

551.594.14

4595. NATURAL AIRBORNE RADIOACTIVITY AT KJELLER, NORWAY. S.H.Small, A.Lillegraven and P.B.Storebø.
Nature (London), Vol. 181, 1197-8 (April 26, 1958).

This was obtained by monitoring continuously the β-activity on a small asbestos air-filter with a flow-rate of ~ 25 litres/min; the radon concentration varied from 30 to 1100 $\times$ 10^{-18} curies/cm^3 with an estimated mean of 300 $\times$ 10^{-18} curies/cm^3 of air. Correlations of activity changes with meteorological changes are being investigated. A.O.Stanesby

551.594.221

4596. A SERIES OF PHOTOGRAPHIC STUDIES ON CLOUD-TO-GROUND AND CLOUD-TO-CLOUD LIGHTNING FLASHES. S.Szpor and J.Kotłowski.
Arch. elektrotech. (Warsaw), Vol. 6, No. 1, 21-50 (1957). In Polish, with summaries (2 pp.) in Russian and (2 pp.) in English.

Sample photographs of flashes taken with a rotating camera in a coastal region of Poland are presented. Records of cloud-to-cloud flashes lasting up to 1.3 sec show a large variation in type and intensity. Very fine branching, displacement of the discharge, and a resemblance to a cloud-to-ground discharge are apparent in the records. Records of cloud-to-ground flashes, which appear to originate from internal cloud discharges, were also obtained. One record shows a "lightning series" lasting 1.02 sec, consisting of three strokes terminating in points on the ground up to 2 km apart, the time between the first and second stroke being 0.037 sec. The only record of a multiple flash shows strokes 0.005 sec apart, followed 0.005 sec later by a number of weaker discharges which appear to originate in higher regions of the cloud. A theoretical interpretation of the observed phenomena is then given. E.M.Dembinski

551.594.5 : 537.564

4597. RELATIONSHIPS BETWEEN AURORAL IONIZATION AND MAGNETIC DISTURBANCE. T.R.Kaiser.
Ann. Géophys., Vol. 14, No. 1, 76-9 (1958).

551.594.5 : 621.396.8

4598. THE IONIZED AURORA. N.C.Gerson.
Nuovo Cimento Suppl. (Ser. 10), Vol. 4, No. 4, 1562-71 (1956).

Cooperative observations by radio amateurs of reflections from aurorae at 50 Mc/s, using a transmitter and receiver at different points, have been made in America over 1949-51. Some results are presented, and compared with corresponding observations of the visual aurora. The seasonal and diurnal variations of occurrence, diurnal variation of auroral duration, location of aurora, and nature of auroral echoes are considered, as well as the possibility of employing scattering of v.h.f. signals at ionized aurorae for communication purposes. G.M.Brown

551.594.5 : 550.385

NEW MODEL OF AURORAE. See Abstr. 4545

551.594.5 : 550.385

THE THEORY OF AURORAE. See Abstr. 4546

551.594.52

4599. HORIZONTAL MOVEMENTS OF AURORA.
J.S.Kim and B.W.Currie.
Canad. J. Phys., Vol. 36, No. 2, 160-70 (Feb., 1958).

Measurements on the drifts of auroral forms at three stations to the south of the auroral zone in West-Central Canada failed to show evidence of a motion due to the earth's rotation relative to fixed excitation patterns in space. The distribution and the magnitude of the speed of auroral structures parallel and normal to the geomagnetic meridians are substantially the same as for non-luminous ionic irregularities observed by radio methods. The speed of an auroral arc or band parallel to the geomagnetic meridian is apparently constant. Speeds increase with geomagnetic activity, particularly in an east–west direction. There is no definite indication of a reversal of the east–west motions close to local midnight. Speeds and directions show no characteristic variations with the time of night. A.

BIOLOGY

578.087.87 : 621.317.79

4600. ELECTRONIC INTEGRATOR WITH IMMEDIATE DIGITAL OUTPUT. B.L.Hisey and E.R.Perl.
Rev. sci. Instrum., Vol. 29, No. 5, 355-9 (May, 1958).

A method is presented for instantaneously obtaining a numerical value proportional to the area of a recurring voltage transient. The underlying principle is the summation of pulses from a generator whose repetition rate is a linear function of the instantaneous input voltage. The technique allows accurate gating to reduce the effects of unwanted signal and noise and has a high order of stability and linearity. The particular device actually constructed and tested was designed to measure the area of the roughly triangular voltage change, about 1 msec in duration, produced by ventral root nerve fibres activated in a monosynaptic reflex. A.

591.51 : 534.3

4601. FACETS OF EXPLORATIONS IN TONAL MEMORY. C.C.O'Brien.
J. Acoust. Soc. Amer., Vol. 30, No. 4, 362 (April, 1958).

Brief suggestions are made for research into tonal and musical memory. H.D.Parbrook

MEDICAL SCIENCE. HUMAN PHYSIOLOGY

61 : 539.164

ALPHA-RAY ACTIVITIES OF HUMANS AND THEIR ENVIRONMENT. See Abstr. 4290.

612.171 : 534.321.9

4602. ULTRASONIC DOPPLER METHOD FOR THE INSPECTION OF CARDIAC FUNCTIONS. S.Satomura.
J. Acoust. Soc. Amer., Vol. 29, No. 11, 1181-5 (Nov., 1957).

When a continuous ultrasonic wave is transmitted towards the heart from the surface of the chest wall, the cardiac motion imposes a Doppler effect upon the partial wave reflected from it. Therefore, an apparatus suitably constructed for sending and receiving ultrasounds is quite useful for the investigation of the movements of the atrium, ventricle, or valves, etc., through the analysis of the particular Doppler signals developed from the motion of the respective parts. A method was developed for the inspection of cardiac functions by recording these Doppler signals simultaneously with the electro- and phonocardiographs on oscillograph paper. This method made it possible not only to obtain direct information on the valvular movement that could not have been ascertained up to the present, but also to examine the transitional aspects of the myocardial excitation, which is quite undetectable by the electrocardiograph alone. A.

612.76

4603. NOTES ON JUMPING. P.Kirkpatrick.
Amer. J. Phys., Vol. 25, No. 9, 614-16 (Dec., 1957).

Sutton's conclusion about the forces on the human tibia is shown to be invalid but correct (Abstr. 1774/1956). There is no rational basis for the fairly common impression that broad jumpers should take off at 45°. Subject to simplifying assumptions about the mechanism of the broad jumper, it is shown that athletes in this event should take off at less than full speed. The leg motions of broad jumpers in air serve a useful purpose. A.

612.843

4604. MOVING VISUAL IMAGES PRODUCED BY REGULAR STATIONARY PATTERNS.
M.H.Pirenne; F.W.Campbell and J.G.Robson; D.M.MacKay.
Nature (London), Vol. 181, 362, 362, 362-3 (Feb. 1, 1958).

The effects, reported by MacKay (Abstr. 467/1958), are ascribed to fluctuations in the state of accommodation of the eye. MacKay disposes of this argument because the effects are observed also when the ciliary body is paralysed, and when the time of stimulus exposure is 1.5 msec. R.A.Weale

612.843

4605. PERCEPTUAL STABILITY OF A STROBOSCOPICALLY LIT VISUAL FIELD CONTAINING SELF-LUMINOUS OBJECTS. D.M.MacKay.
Nature (London), Vol. 181, 507-8 (Feb. 15, 1958).

Experiments on the apparent movement of external objects, induced by a variety of methods, support the view that "what requires information justification is not the maintenance of stability but the perception of change". R.A.Weale

612.843.721

4606. A NEW INSTRUMENT FOR TESTING STEREOSCOPIC VISION. N.Bárány.
Periodica polytech., Elect. Engng, Vol. 1, No. 1, 3-25 (1957).

The observer has to produce coincidence between an object and its image formed by a concave mirror, when both are viewed binocularly. Conditions are chosen so as to render negligible the difference between object and image size. R.A.Weale

612.858.71

4607. COMPARISON OF THE AUDITORY THRESHOLD AS MEASURED BY INDIVIDUAL PURE TONE AND BY BÉKÉSY AUDIOMETRY. W.Burns and R.Hinchcliffe.
J. Acoust. Soc. Amer., Vol. 29, No. 12, 1274-7 (Dec., 1957).

Twenty subjects, aged 20 to 58 yrs, were clinically screened to exclude gross otological pathology. Their auditory thresholds were then determined, both by Békésy audiometry and by conventional individual pure-tone audiometry by the method of limits, in 2 dB steps. Measurement of the threshold of hearing by either method gave essentially similar results, and the reliabilities of the methods were of the same order for all frequencies tested. When both tests were repeated after an interval of one week, mean improvements of 1 to 2 dB were found at all frequencies by the Békésy method, and in all but one by the individual pure tone method. In both methods, however, improvements were significant only at 1000 and 3000 c/s. A.

614.898

4608. PROTECTION AGAINST NEUTRON RADIATION UP TO 30 MILLION ELECTRON VOLTS.
Handb. Nat. Bur. Stand., No. 63, 88 pp. (Nov. 22, 1957).

The handbook presents an exhaustive survey of the available physical and biological information on neutrons and their interaction with matter in the energy range from 10^{-4} eV to 3×10^{7} eV. Data are presented on neutron/tissue interactions and on the biological effects of neutron beams (including conservative R.B.E. estimates and other data allowing the calculation of absorbed dose). Figures are quoted for the maximum permissible neutron exposure in typical situations, the associated gamma- and X-ray hazards are considered, and methods for dose and flux measurement are presented. Radiation protection methods, including shield design, are surveyed for the commonly occurring types of neutron source (radioactive sources, constant-voltage accelerators, and high-frequency accelerators). Rules for protection against neutron radiation are presented, and a procedure is suggested which is to be applied in the case of an accidental over-exposure. In a series of useful appendices information is given on such matters as neutron depth dose, the practical use and calibration of flux detectors and radiation-measuring instruments, data for shield calculations, and a brief consideration of neutron protection near high-energy electron accelerators is included. An extensive list of references to the literature is given. N.H.Gale

TECHNIQUE. MATERIALS

620.11 : 535.371

OPTICAL FLUORESCENCE IN NON-DESTRUCTIVE TESTING.
See Abstr. 3887

620.191/.2

4609. SYMPOSIUM ON PRINCIPLES OF PENETRANT METHODS.
H.L.Carson; W.G.Cook; R.Schnurmann.
Brit. J. appl. Phys., Suppl. No. 6 (Physics of non-destructive testing), S18-S19, S19, S19-S21, S21-S23 (1957).

I. Carson discusses the advantages and disadvantages of penetrant methods of crack detection compared with magnetic methods for ferromagnetic material. It is concluded that fluorescent methods are more satisfactory than penetrants employing a dye, and a summary is given of the views of a panel of the British Welding Research Association.

II. Cook poses eleven questions as a framework for research towards ascertaining what the underlying physical principles are that make crack detection by penetrants successful.

III. Schnurmann discusses the three different types of fluorescent ink used according to their physical action, and follows this with a brief discussion of the dye penetrant method. The selection of the most efficient penetrant method must be made on empirical grounds for any particular instance.

These papers are followed by a report of the discussion on them.

621-47

4610. TECHNIQUE OF OBTAINING A MINUTE PINHOLE IN A METAL PLATE. T.Numata.
J. Phys. Soc. Japan, Vol. 12, No. 5, 559 (May, 1957).

A drop of low-melting-point alloy, held in a small hole in a metal plate, is allowed to solidify round a glass fibre of diameter 10 to 50 μ; the fibre is then pulled out. A.R.Stokes

621.762 : 539.17

4611. STEPS IN PREPARING URANIUM DIOXIDE FOR FUEL ELEMENTS. H.H.Hausner and R.G.Mills.
Nucleonics, Vol. 15, No. 7, 94-103 (July, 1957).

Ceramic fuel materials have good corrosion resistance, stability against radiation damage, low thermal expansion and adequate strength at high temperatures. UO_2 has the highest melting point of refractory uranium compounds and is well suited as a high temperature reactor fuel. Production of UO_2 powder and fabrication by compacting, slip casting or extrusion, followed by sintering in an inert atmosphere at about 2000°C, is described. The small amount of oxygen absorbed from air by UO_2 is found to play an important part in the sintering process. A table of the physical properties of UO_2 and an extensive bibliography are included. R.D.Smith

621.77

4612. A PORTABLE LAMINATION DETECTOR FOR STEEL SHEET. B.O.Smith, A.P.H.Jennings and A.G.Grimshaw.
Brit. J. appl. Phys., Vol. 9, No. 5, 191-3 (May, 1958).

The laminations are detected by the distortion they cause in the flow pattern of an electric current through the sheet. Direct current is passed through the sheet between two contacts on opposing faces while the potential difference between two adjacent contacts is measured. This potential difference is very small in sound material, but rises sharply if a lamination is present. Not every lamination can be detected by this method because, for this to happen, it is essential that it should form an electrical discontinuity. For example, experience has shown that in hot-rolled strip most of the laminations are not detected, but in cold-rolled strip the great majority above 0.25 wide do form a discontinuity and can be detected with certainty by the instrument. A

66.083.:

4613. SOME HIGH-PRESSURE, HIGH-TEMPERATURE APPARATUS DESIGN CONSIDERATIONS: EQUIPMENT FOR USE A 100 000 ATMOSPHERES AND 3000°C. H.T.Hall.
Rev. sci. Instrum., Vol. 29, No. 4, 267-75 (April, 1958).

Three items of equipment are described in detail; (1) A simple-piston and cylinder device capable of generating pressures to 50 000 atm simultaneously with temperatures of 5000°C, (2) a tetrahedral-anvil device that has been successfully tested at 100 000 atm and 3000°C, and (3) a stepped-piston device capable of developing pressures to 200 000 atm at room temperature. In addition consideration is given to such problems as (a) geometrical elements of design, (b) higher strength materials, (c) use of mechanical anisotropy in design, (d) electrical leads, (e) thermal and electrical insulation, (f) solid pressure transmitting media, (g) binding rings, (h) internal generation of pressure, (i) multistaging, and (j) calibration. A.

669

4614. A SIMPLER METHOD FOR REMOVING COPPER FROM GERMANIUM. M.Kikuchi and S Iizima.
J. Phys. Soc. Japan, Vol. 12, No. 7, 824 (July, 1957).

This uses the feature that lattice defects act as sinks for Cu atoms. By roughening the surface of Cu-doped specimens with HNO_3, heating at 650°C for 1½ hours in rare gas and then etching the surface with CP4, removal of copper was achieved, only a few percent remaining after several cycles of the treatment.

D.Haneman

669.054

4615. MAGNETIC STIRRING TECHNIQUE.
W.G.Pfann and D.Dorsi.
Rev. sci. Instrum., Vol. 28, No. 9, 720 (Sept., 1957).

The method is applicable to conducting substances and useful in solidification techniques, such as zone refining. A direct current is passed through an ingot in a horizontal boat and a localized steady magnetic field applied normal to the ingot near one end of the molten zone. Vigorous stirring was obtained in molten zones of Pb, 2 cm long and 1 cm^2 cross-sectional area, for 20 A/cm^2 current density and 500 Oe/cm field gradient. Other applications are briefly indicated. S.Weintroub

678.84 : 621.315.617.5

4616. SILICONES AND THEIR APPLICATIONS. J.Ames.
J. sci. Instrum., Vol. 35, No. 1, 1-8 (Jan., 1958).

The characteristics of the polysiloxane chain are described, and their effects on the properties of silicones are discussed. Silicones possess excellent thermal stability over a temperature range of more than 300 deg. C, low surface tension, good electrical properties and a high degree of water repellency, and are effective as release agents. The mechanical properties of the condensed polysiloxanes are poorer than those of most organic polymers at moderate temperatures, but are markedly superior at extremes of temperature. Silicones are available in the form of fluids, rubbers and resins; the manufacture and properties of each are described, and their special applications are discussed. A.

LIST OF JOURNALS

The following list supplements the List of Journals published with the June number of Volume 60 (1957) and the Supplement published with the Index to the same volume. Reprints of the List of Journals and of the Supplement can be obtained from The Institution of Electrical Engineers, Savoy Place, London, W.C.2, price 2s.0d. post free.

The addresses given are believed to be correct at the date of publication, but no responsibility can be accepted for errors.

Quart. Rev. Chem. Soc.	Quarterly Reviews of the Chemical Society. The Chemical Society, Burlington House, London, W.1.
Soviet Physics — Technical Physics (New York)	Soviet Physics — Technical Physics. The American Institute of Physics, 335 East 45th Street, New York 17, N.Y. [A translation of the Journal of Technical Physics of the USSR.]

NOTES

Tecn. Ital.	Tecnica Italiana. The "New Series" volume numbers initiated in 1946 were discontinued at the end of 1957, and the volume numbers are, from the beginning of 1958, again being counted from the year of foundation of the journal. Thus the 1958 volume is "Anno 23", though the 1957 volume is "New Series 12 (Anno 22)".

ERRATA

Abstr. 3971 (1955) line 9 : for "0.000 71" read "0.007 1".
Abstr. 3307 (1956) line 11 : for "increases" read "decreases".
Abstr. 1493 (1958) line 2 : for "Tzou Kuo-Hsein" read "Tzou Kuo-Hsien".
Abstr. 2508 (1958) line 6 : for "equal" read "opposite".

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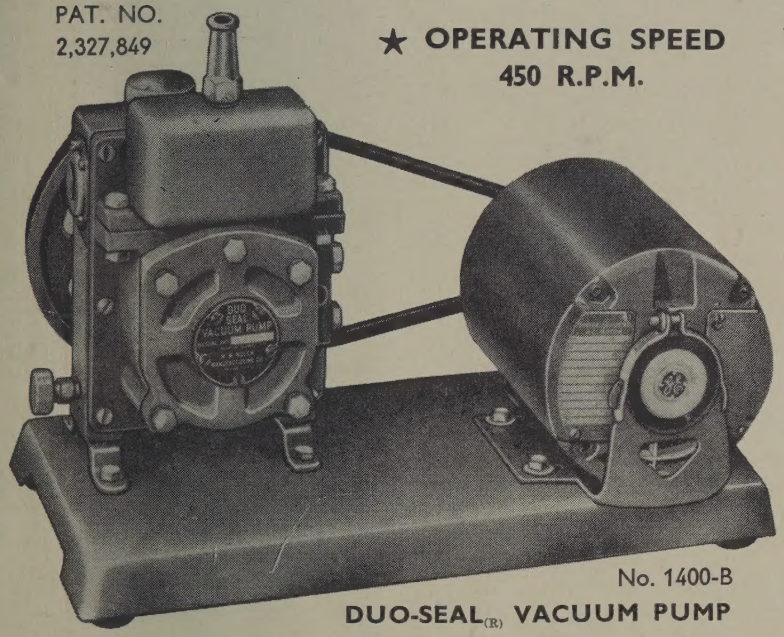

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